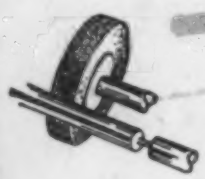
SEP 21 1956

Grinding and Finishing

The Magazine Devoted Exclusively to Abrasive Operations

OCT 4- 1956



★ FEATURES

Significance and Measurement of Surface Finish

Outstanding Abrasive Operations on Cummins Diesels

Three Recent Developments in Work Holders and Drivers

If You're Going To Blast Clean—Use the Right Abrasive

ALSO IN THIS ISSUE

Shop Hints and Kinks
Safety
Letters to the Editor
Free Literature
What's New in Equipment and Materials

WHEELS • GRINDING • HONING • LAPPING MACHINES • ACCESSORIES • PORTABLE GRINDERS • TUMBLING • ABRASIVES

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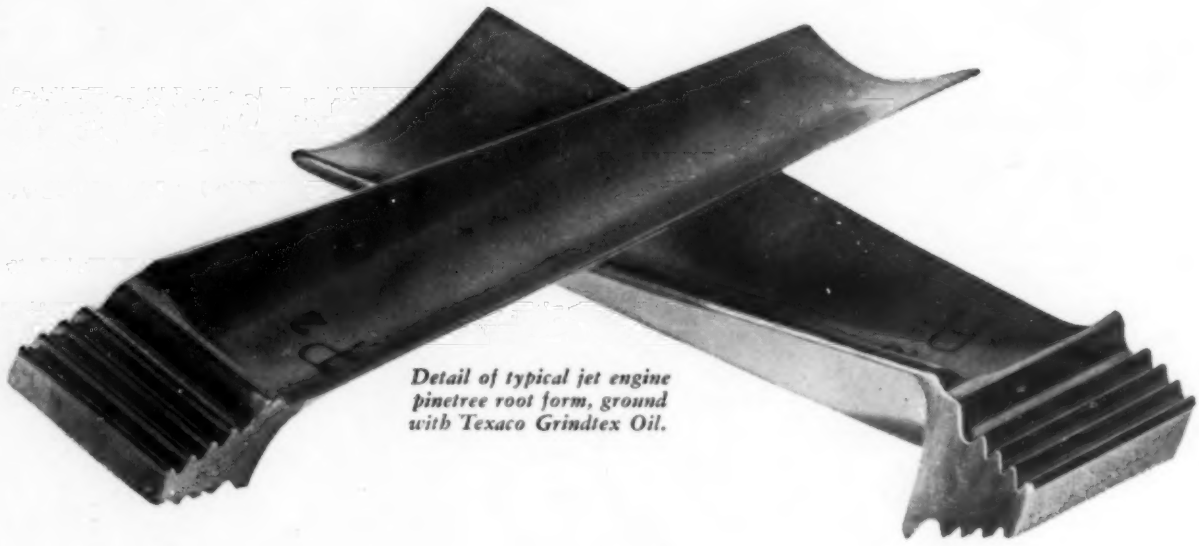
SEPTEMBER 1956



Detail of typical jet engine pinetree root form, ground with Texaco Grindtex Oil.

Grinds more "pinetrees" between wheel dressings

UTICA DROP FORGE is one of the country's top producers of jet engine blades—doing the complete job from vacuum-melting the alloy to precision forging and finishing.

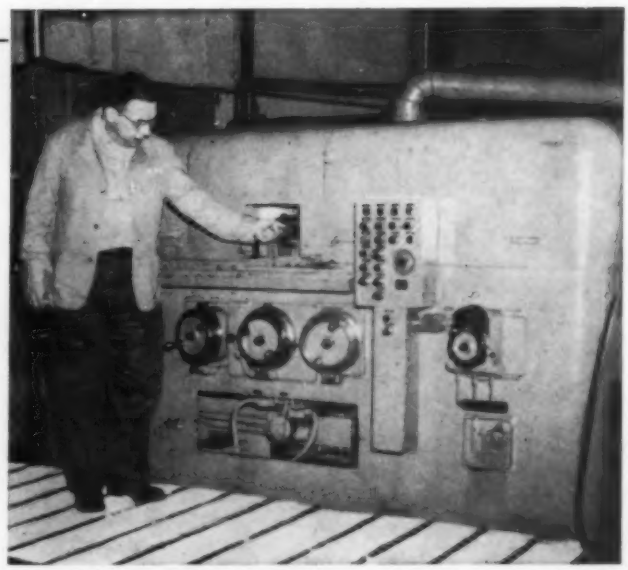
For the critical form grinding of pinetree and dovetail roots, as well as air foil contours, a Texaco Lubrication Engineer recommended *Texaco Grindtex Oil*—and its use has proved outstandingly successful.

Utica Drop Forge finds *Texaco Grindtex Oil* an important help in holding to the required close tolerances and achieving consistently excellent finish. Wheels last longer and fewer dressings are needed. These benefits add up to a higher output of perfect parts at a lower unit cost.

Be sure you're getting the most from *your* machines. There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do *all* your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.



One of the Ex-Cell-O Precision two-wheel form grinders at the Clayville, New York, plant of Utica Drop Forge & Tool Corporation. Adapted Norton and Thompson grinders are also in use. Metals worked are Nimonic 80 and 90, Iconel 700, Stellite and stainless steels. *Texaco Grindtex Oil* is doing a great job here.

VISIT Texaco Booth 1602, Metals Show, Cleveland, October 8-12

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

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SEPTEMBER, 1956—VOL. 2, NO. 5

Grinding and Finishing

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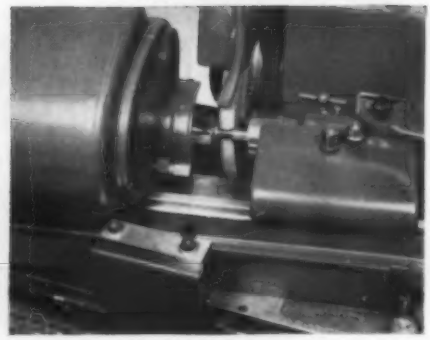

A short, short part . . . grinding the back face and shoulder of nozzles, 83 per hour, with the aid of a special holding device. This 4" Plain Hydraulic Grinder handles other operations, too.

How to
of Grinding

CINCINNATI FILMATIC 4" Plain Hydraulic Grinding Machine. Complete specifications may be obtained by writing for catalog No. G-551-2.

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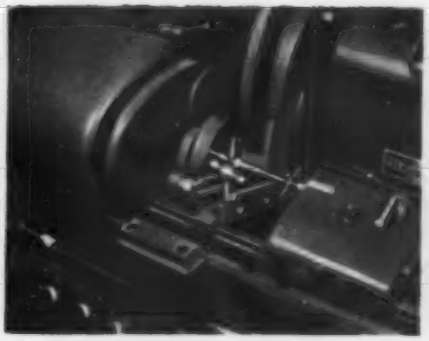

Crankshafts with .030" throw ground from the solid. Cincinnati Application Engineers tooled up a 4" Plain Hydraulic for this job with a work holding fixture featuring repetitive stopping for convenience in loading.

Micrometer barrels, 200 per hour, grinding diameter and bevel simultaneously. This 4" Plain Hydraulic is equipped with work cradles, hydraulic footstock, automatic infeed, and a special table type profile wheel truing unit.

Armature shafts, grinding two diameters in two setups, 200 per hour per diameter. Labor-aiding equipment for the 4" Plain Hydraulic illustrated here consists of automatic infeed, hydraulic footstock, and work cradles.

Cut the Cost

Small Precision Parts

In general, the cost of machining operations on small parts should be very low. Four examples of how this goal is attained with CINCINNATI® FILMATIC 4" Plain Hydraulic Grinding Machines are illustrated here. All are typical parts, with standard tooling or slight alterations on the machine to attain the highest rate of production at the lowest cost and minimum physical effort. Read how CINCINNATI FILMATIC 4" Plain Hydraulics contribute to these desirable results.

1) FILMATIC grinding wheel spindle bearings require no adjusting or maintenance
2) The bed is recessed so workers may be seated, yet all operating elements are at their finger tips
3) Automatic Infeed Attachment controls the complete grinding cycle (extra equipment)

You may obtain more data by writing for literature, or look in Sweet's Machine Tool Catalog for brief specifications.

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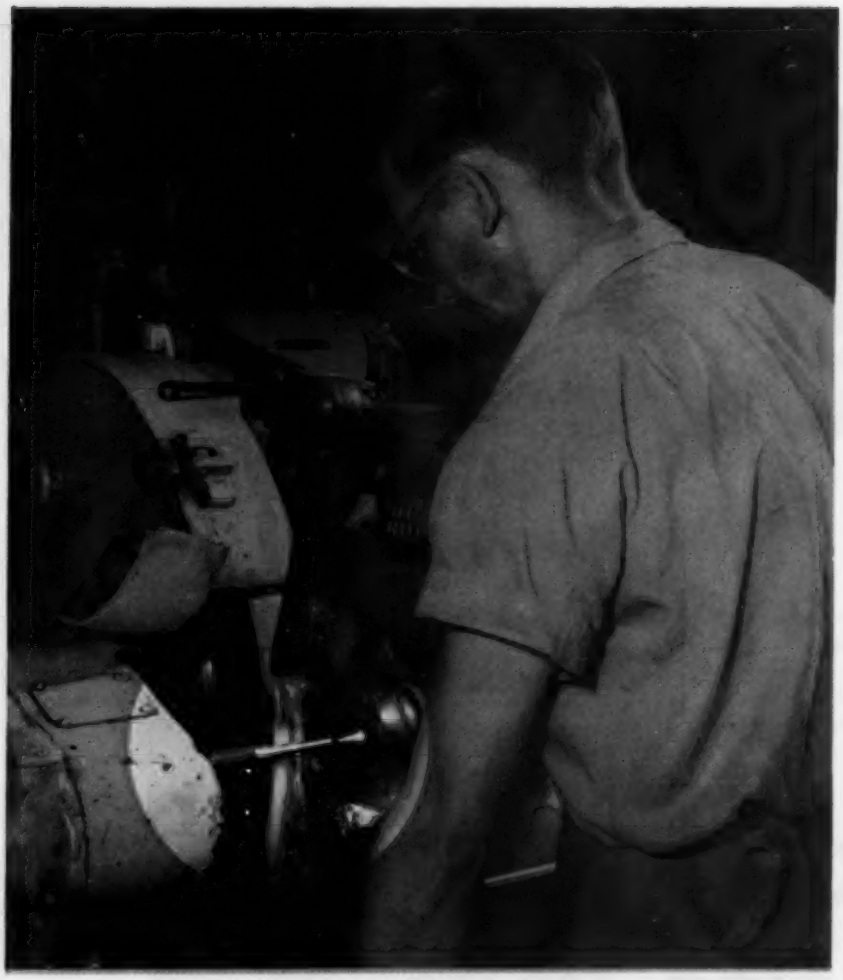

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Letters to the Editor

Surface Finish

We read with interest the article by Mr. Bolles on surface finish in your August issue. May we have more articles on this subject? It would be especially helpful if another article would explain the engineering and design reasons for selecting one particular finish for a part function in a machine.

H. R. Clark
Denver

The definitive two-part series on significance and measurement of surface finish by Mr. R. E. Reason beginning in this issue will probably be of great interest to you. It's encouraging to us to see a growing concern about surface finish specification and measurement among production men. The new ASA standards for specification will be a big help along that line. Another important topic GRINDING AND FINISHING hopes to discuss in the near future is the cost angle—just how much do you pay for a given finish.

Wheel Dresser

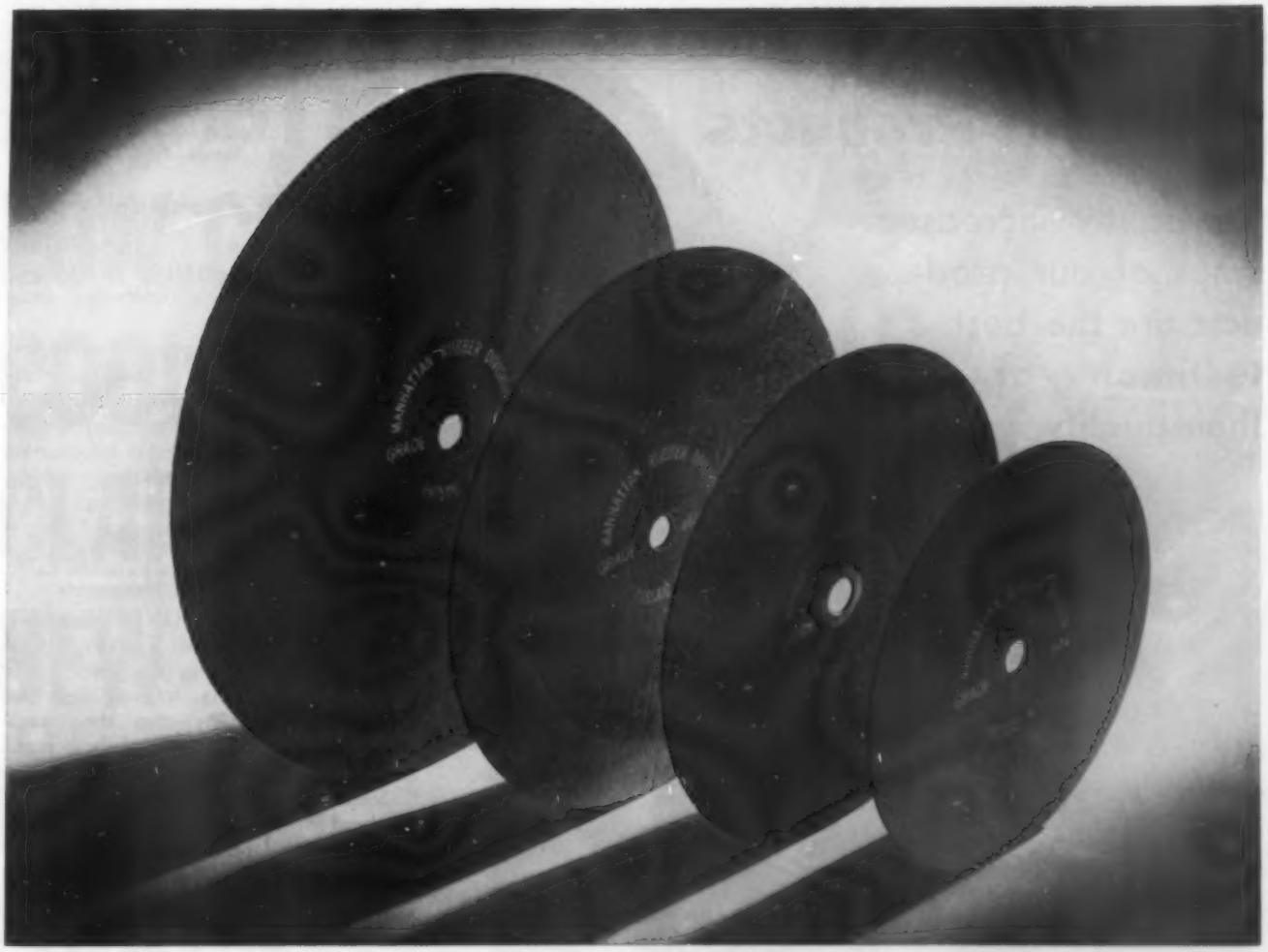
. . .would you be good enough to tell me whether you have any information on grinding wheel dressing attachments for grinding forms on a one-to-one template ratio.

Aaron Wernor
Los Angeles

After checking with a number of users of template-tracer dressers, we suggest that there would be little advantage in using a tracer-type form dressing attachment with the ratio you have specified, since there are a number of simple mechanical dressers on the market to do that type of job. A one-to-one ratio would nullify the principle advantage of using a template dresser, which is the inherent accuracy you get by using a large template of slight accuracy, through a reduction.

Regrinding Chuck Jaws

While the recent idea by Mr. Gerber on regrinding chuck jaws (August, 1956 G &F, p. 42) is an interesting approach, I don't consider it as reliable because on the final grinding he uses the thread surfaces as the supporting base. If the chuck body and the slides are worn—usually they are—these threads will not rest perpendicular with-



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Safe, fast, clean cutting over sustained periods saves you both time and money. Manhattan Cut-Off Wheels give you cleaner cutting at higher speeds because every wheel is custom-bonded for your specific cut-off job . . . whether you work with hardened or soft steel, light gauge tubing or critical alloys. New Manhattan developments in both rubber and resinoid bonds account for this greater cutting efficiency . . . and longer life for the wheels. In factories where records are kept of the number of cuts per wheel, Manhattan wheels have proved they do a better job . . . and *last longer* than any other wheels.

Manhattan Cut-Off Wheels are custom-manufactured for your requirements in the widest range of types and sizes. Manhattan Abrasive Wheel engineers will assist you in specifying the exact construction to improve cut-off operations at your plant. They'll show you how you can save time and money . . . get "More Use per Dollar" . . . with Manhattan Cut-Off Wheels and other types of high speed, heavy duty wheels.

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in the chuck, causing a slightly bell-mouthed jaw grip. The jaws should be ground in their actual position in the chuck, even though it takes longer.

H. Landauer
Tool Service
Tampa, Florida

Small Plant Automation

We note in the August publication of GRINDING AND FINISHING, page 18, an article concerning small plant automation.

We have in our plant eleven No. 2 Cincinnati centerless grinders and were interested in the attachments as shown in the write-up. . . Is there any way by which we could get further information on the attachments and the possibility of purchasing such attachments?

W. J. Callaghan
Stupakoff Division of
The Carborundum Co.
Latrobe, Pennsylvania

At the time GRINDING AND FINISHING visited Twentieth Century Manufacturing, the owner, Mr. W. L. Garberding, told us there was a good possibility that the attachment would be marketed if the demand for it appeared high. Since then, we've learned that Mr. Garberding has moved ahead with this plan. The attachment will be available, through Modern Devices, Box 429, Libertyville, Illinois.

Reprints

From time to time I have received and read with much interest copies of your very excellent magazine. Am enclosing my cheque herewith, and would appreciate your entering my subscription to begin at once.

Are back copies available?

Would also like to receive a copy of the five-part series of articles on "Centerless Grinding", which I understand is available at 35 cents. . . .

If you have a list of other reprint articles available, would like one also. One of the Letters to the Editor in your June 1956 issue mentioned such a list which apparently appeared in the February 1956 issue on page 45. Wonder if this is what I want?

May I hear from you as soon as possible.

D. H. Thompson
Canadian Carborundum Co., Ltd.

Upon reading your magazine, GRINDING and FINISHING, I noticed a reprint that was available. It is "What Is the Smallest Radius That Can Be Dressed With a Wheel Dresser?" by Henry F. Swenson.

Would you please send this reprint . . . to me by return mail. . . .

C. W. Mander,
Tool Room Foreman
Smith Welding Equipment Corporation
Minneapolis, Minnesota

AT LAST! LOW COST COOLANT CLARIFICATION... NEW DE LAVAL COOLANT CLARIFIER...

Designed for *individual* use on grinding, honing or turning units, the new De Laval Model 115 Coolant Clarifier lengthens coolant life . . . eliminates costly filter replacements . . . reduces down-time for tool replacement and dressings . . . removes all types of contaminants.

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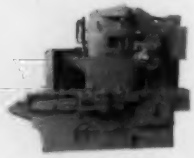
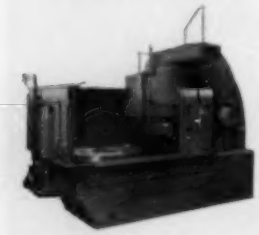


Blanchard No. 18



Blanchard No. 42-84

There's a Blanchard for every surface grinding job, in a broad range of sizes. For example, the Blanchard No. 18 grinds non-magnetic transistor elements (upper left) .006" thick, to a tolerance of .0005" with good finish. This job, which involved .006" to .008" stock removal per side, was held on special fixture plates.

At the other end of the scale, a huge Blanchard No. 42-84 Grinder grinds a turbine housing (upper right) which measures 83" across the corners, and is 28" high. This housing, ground after rough machining, required .020" stock removal. Both this piece and its mating part were ground to a steam-tight joint.

Whatever *you're* grinding—be it tiny watch parts, giant steel plates, or anything in between—there's a Blanchard designed to do the job speedily and accurately.

Ask for details on the 15 standard Blanchard models.

PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

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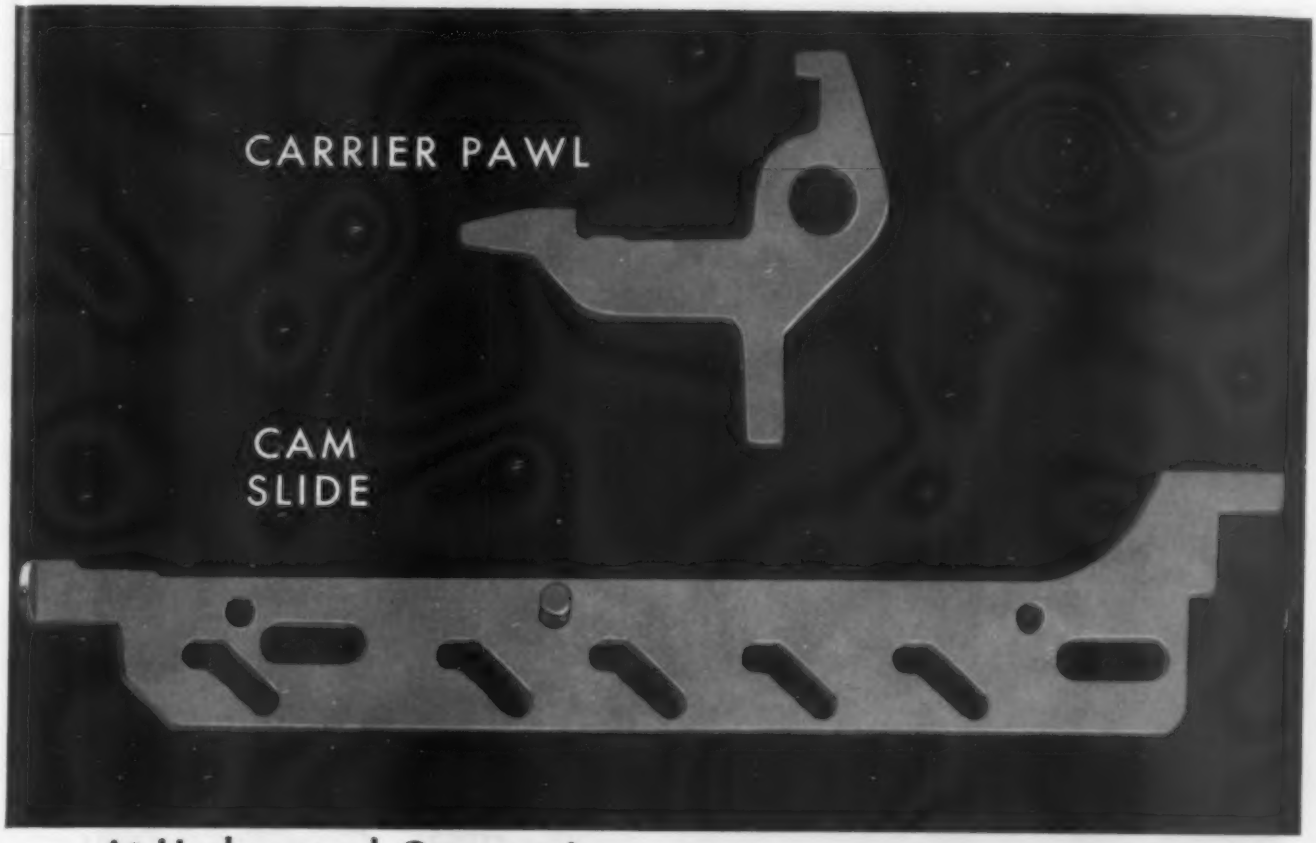

At Underwood Corporation . . .

HONITE Method Saves $11,750 On Finishing Precision Stampings

The Underwood Corporation, Bridgeport, Conn., puts 1000 *different* precision-made parts into their standard adding machine. Recently this company switched to the Honite barrel finishing method . . . and look at some typical results!

CARRIER PAWL About 1,000,000 of these cold-rolled steel parts are made each year. By the old combination of hand-finishing and tumbling methods, it required 15 separate operations to make each pawl — from blank to finish-plated. With the Honite Method, the *total* number of steps has been cut to 6 — with an annual saving on this part alone of $11,750!

CAM SLIDE The sides of this cold-rolled steel part must be exceedingly smooth because they are in direct contact with other surfaces, and tolerances must be held to .002" - .003". The old hand-honing method required 3900 man-hours per year to produce these parts. The Honite barrel finishing method has cut the total annual man-hours to 500!

The average overall cost for finishing parts by the old method varied from $.70 to $1.10 per 100 pieces. With the Honite barrel finishing method costs were cut to an average of $.10 per 100 pieces — a 91% saving. The company's investment in Honite barrel finishing equipment was thus paid off in *less than a year!*

You, too, can cut costs with the Honite barrel finishing method. Send coupon today for full facts.

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☐ *Send me free copy of "Facts and Figures Report on Honite Barrel Finishing."*

☐ *I'd like to talk to a Honite Sales Engineer.*

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If you are not currently using Electro Wheels we should welcome an opportunity for one of our abrasive specialists to explain some of the ways we believe Electro can reduce your snagging costs.

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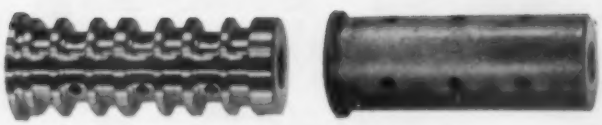
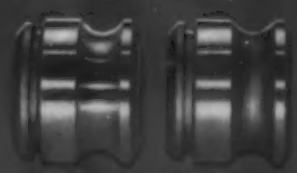


Servo Mechanism Sleeve

The seven grooves of this servo mechanism sleeve are crushtrue ground from the solid to a tolerance of .001" on spacing and .002" on minor diameter in 55 seconds. Material, SAE 52-100; Rockwell, 58-60 C; depth of plunge grind, .145".

Forms and grooves are precision ground on these machines with comparable speed and economy.

For complete details write to Department 6, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.

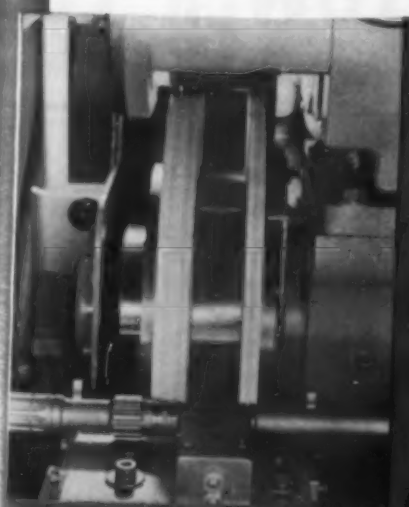


Bearing Race

Aircraft Servo Component

Hydraulic Servo Units

Self-aligning Bearings



Grinding Grooves in a Transmission Shaft

Crushtrue Roll

MASTER CRAFTSMAN GOLDEN ANNIVERSARY HEADQUARTERS

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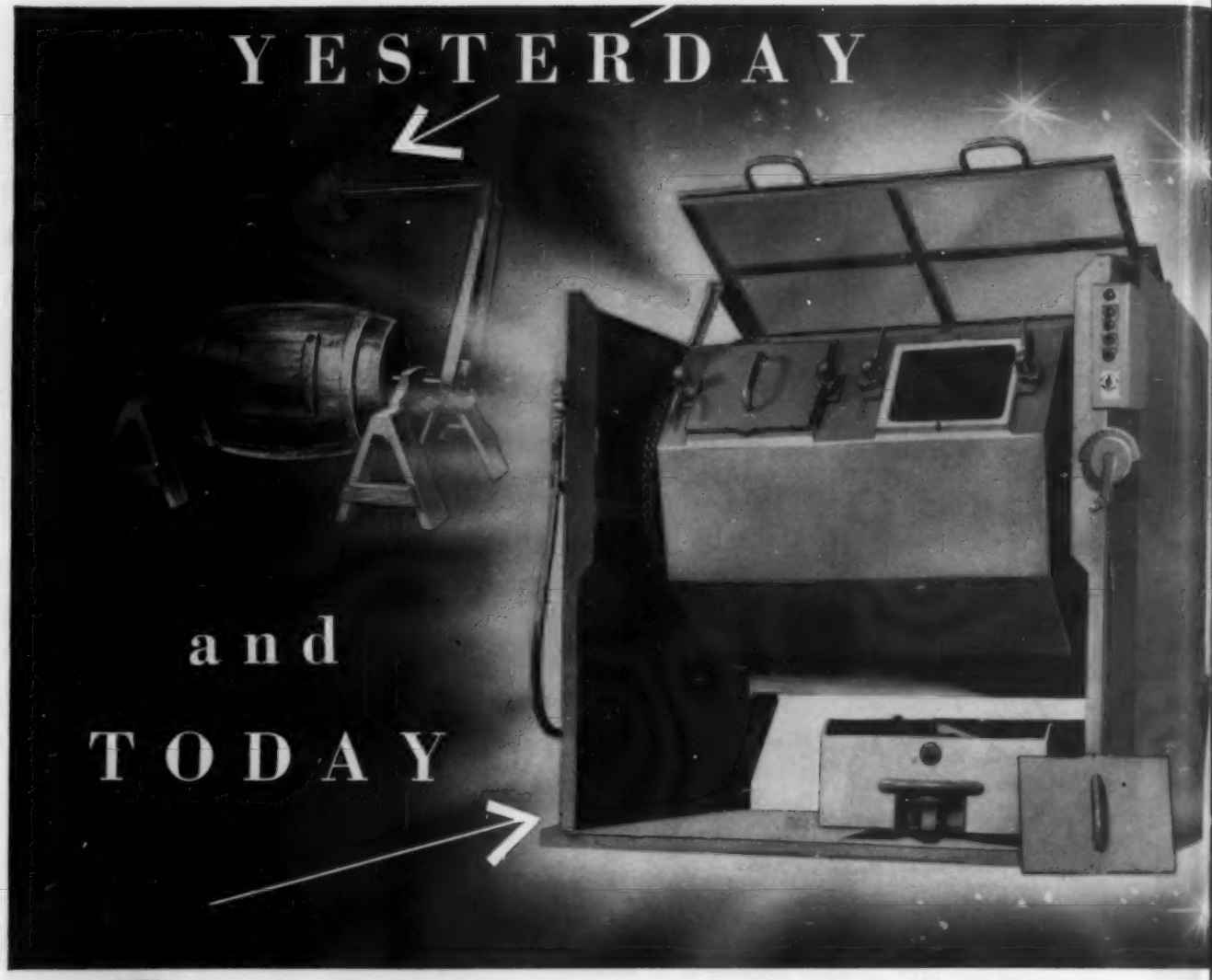
Precision Measurement for Industry



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Cuts labor costs — Increases production — Assures uniform finish

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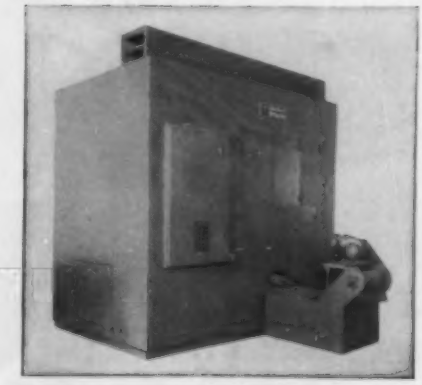
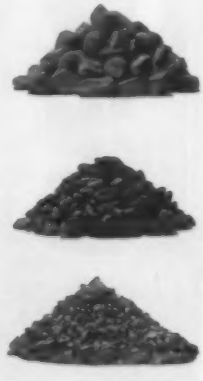


ROTOMATION MACHINE



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Through the years, ROTO-FINISH has taken yesterday's rough and ready method of tumbling and developed it into mass production precision barrel finishing.

Today, the demands of industry call for better finishes than ever before and stepped up production calls for faster processing of parts. Competitive markets require assurance of performance before investments are made in new equipment.

Roto-Finish equipment and service offers you finishing facilities tailored to fit your needs. No two finishing problems are exactly alike. Roto-Finish offers the widest variety of machines and equipment on the market today. You can be sure you're getting the best equipment to solve your problem from Roto-Finish.

Literally thousands of different parts are being ground, deburred, descaled, polished, BRITE-HONED, and colored more economically and with better results than ever before by Roto-Finish processes. Materials finished include metals and alloys, plastics, glass, ivory, wood, rubber and ceramics. Whether your problem is a small or medium sized part or one that weighs a hundred pounds, the chances are good that you'll save on finishing costs with Roto-Finish.

NO COSTLY TRIAL AND ERROR TO GET THE RIGHT EQUIPMENT

There's no guesswork involved in selecting Roto-Finish equipment. Experienced engineering personnel process samples of your product in Roto-Finish laboratories to determine the right combination of machine and materials to produce exactly the finish you want. This is done without obligation on your part. You purchase nothing until you are satisfied that the equipment will produce the desired finish . . . at a savings to you.

Roto-Finish also helps you in seeing that proper installation is made, in training personnel in the most efficient operation of machines, in properly integrating machines and materials for your job and in making free periodic visits to train operators and offer suggestions for improving your products wherever possible.

Begin saving on finishing costs and improve the quality of your product now!

Send us a few samples of your product for processing *without obligation to you.*

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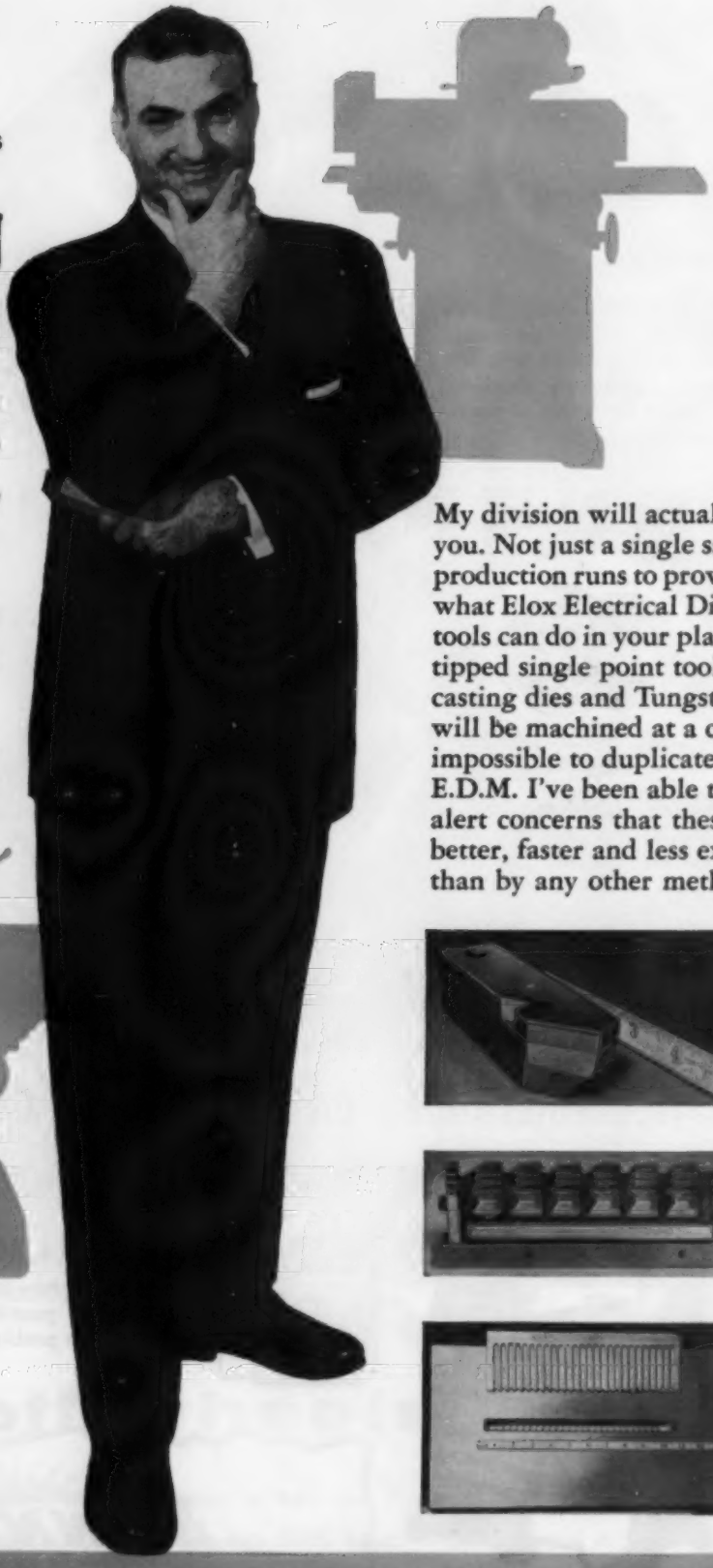

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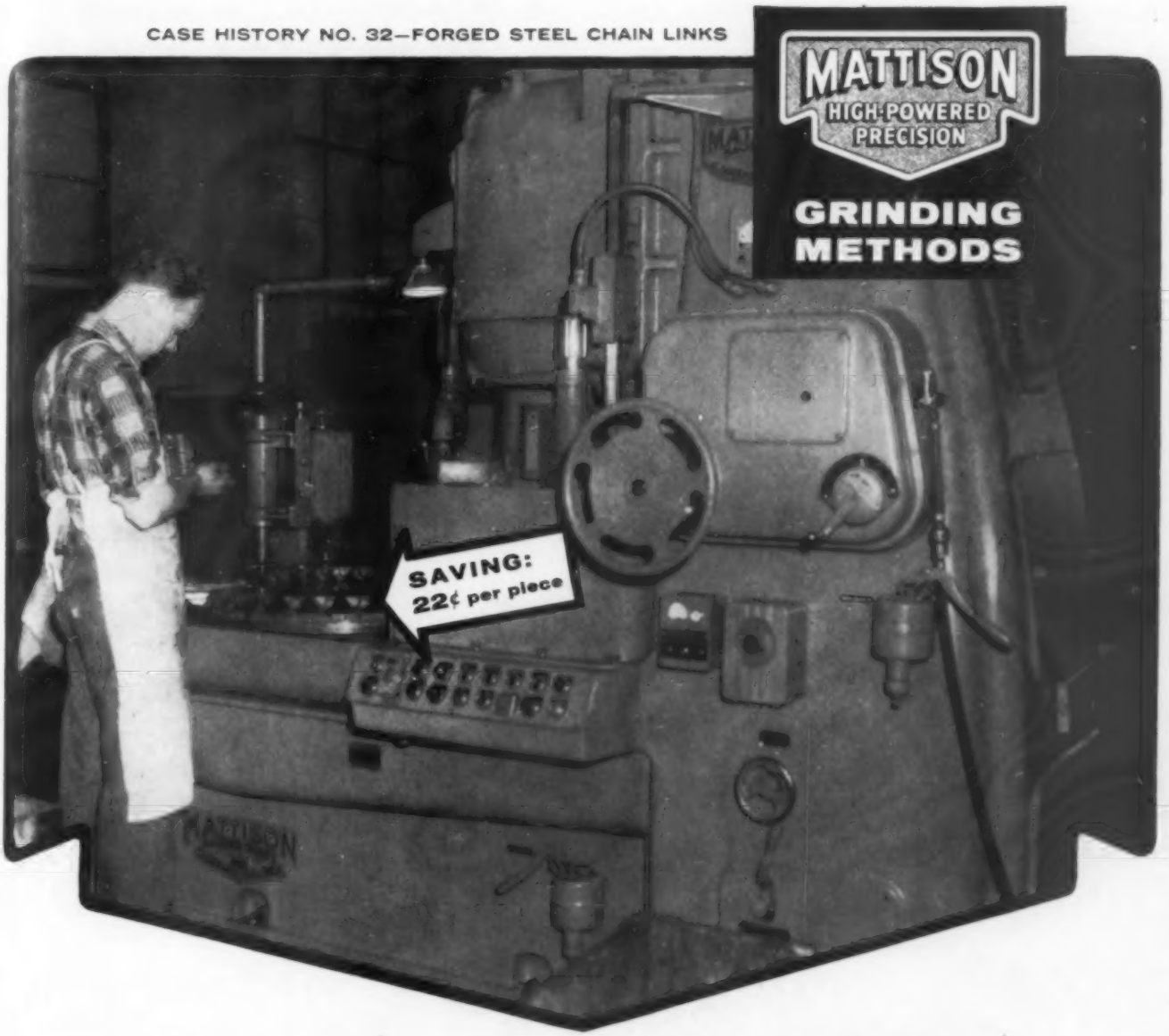
CASE HISTORY NO. 32—FORGED STEEL CHAIN LINKS

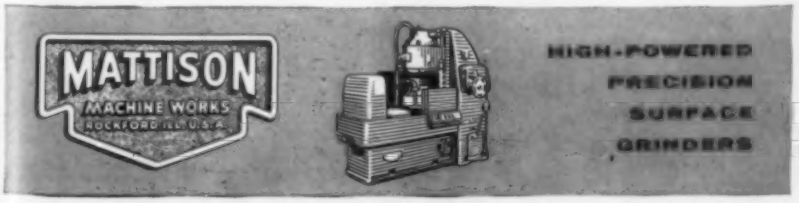


Change from milling to high-powered surface grinding saves 22¢ per piece!

Formerly, these 4140 drop-forged chain links were milled, 100 pieces every three hours, using high-speed steel cutters. Eighteen pieces were produced between sharpenings. At 35 minutes per sharpening, 3.2 hours of cutter maintenance were required for every three hours production at a labor cost of $16. This, plus machining cost of 15¢ per piece, gave a total cost of 31¢ each.

Today, links are machined, 30 pieces per load, at rate of 100 pieces per hour on the Mattison No. 24 Automatic Cycling Vertical Spindle Surface Grinder, equipped with 40 hp spindle motor. Stock removal is .140 in., at .016 in. minimum downfeed per minute. Wheel cost per piece is 4¢, but maintenance cost is eliminated because wheel is self-dressing. With a labor and machine cost of 5¢ per piece, total cost to grind is only 9¢—a saving of more than 22¢ per piece, plus additional savings in cost of cutters.

Mattison Vertical Spindle Rotary Surface Grinders offer continuous downfeed and automatic cycling and sizing of work, to machine large or small flat surfaces accurately and fast. Send your parts to the Mattison Methods Laboratory for a sample grind and production estimate.



Automatic sizer gauges parts continuously and stops automatic grinding cycle when finish size is reached.

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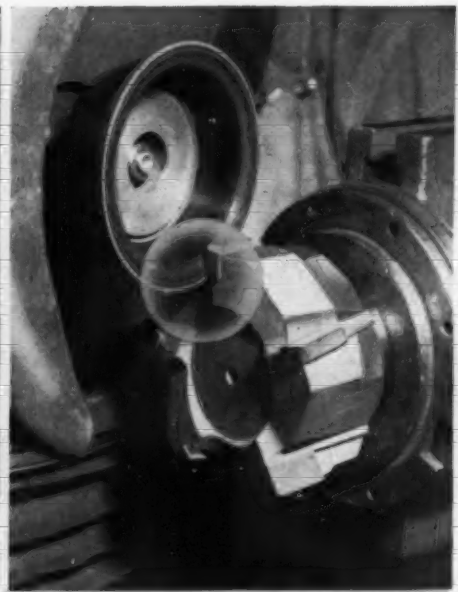
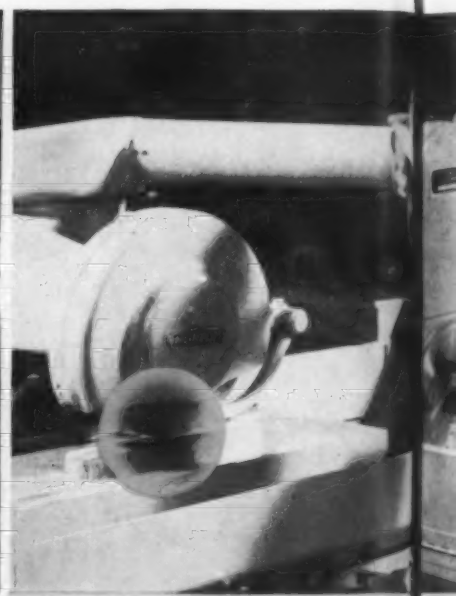
Tool Sharpening



Carbide Grinding



Surface Grinding

...with precision processed,

Norton makes wheels for every grinding job in your tool room — and precision-processes them on the most advanced equipment and with the most experienced "know-how" in the field. The result is precise wheel duplication, longer wheel life, and the same money-saving "Touch of Gold" performance every time you re-order.

Top performers from the 100% line of Norton wheels for tool room grinding include:

G Bond Wheels. Made with the most efficient vitrified bond ever produced for precision and semi-precision grinding. For sharpening and for surface, cylindrical and internal grinding on all steels, use G Bond wheels in the exclusive 32 ALUNDUM* abrasive, 38 ALUNDUM abrasive or 19 ALUNDUM abrasive.

Diamond Wheels by Norton are the recognized "Crown Jewels" for carbide grinding — backed by long leadership in diamond wheel development and manufacture. Made in the regular B resinoid bond for wet grinding and the B6 resinoid bond for dry grinding.

K Bond Wheels in CRYSTOLON* abrasive are an excellent investment for carbide grinding. The vitrified K Bond, in half-grade hardness increments, enables you to "pin-point" specifications.

Cut-Off Wheels made in abrasive-and-bond combinations for all tool room applications, wet or dry, on every type of machine.

to every tool room grinding job

Cylindrical Grinding

Internal Grinding

Cutting-Off

l, precision duplicated Norton wheels

Remember: Norton makes tool room grinding machines as well as wheels . . . knows how to build wheels to machine requirements . . . and offers you the longest experience in both grinding machines and grinding wheels to help you produce more at lower cost. See your Norton Distributor for aid in wheel selection and a copy of the new revised handbook on tool room grinding. Or write to the nearest District Office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

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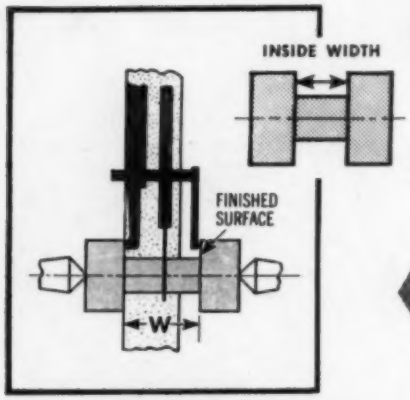
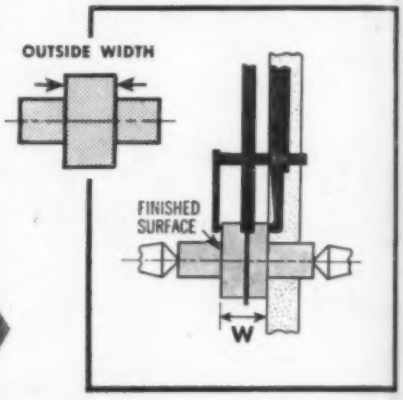
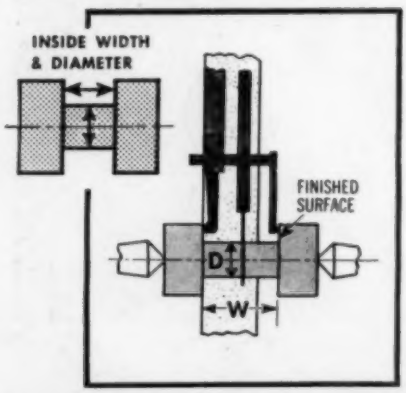
Do you know you can do *these jobs, too* with the Federal Arnold Continuous Grinding Gage?

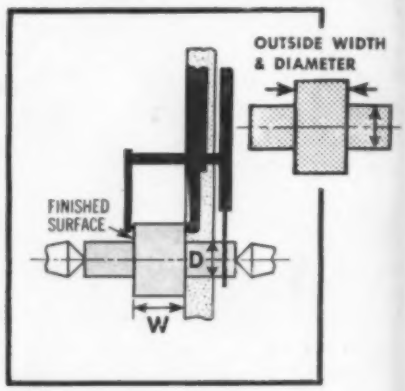


Use Model WF for Inside Width Gaging or for Outside Width Gaging

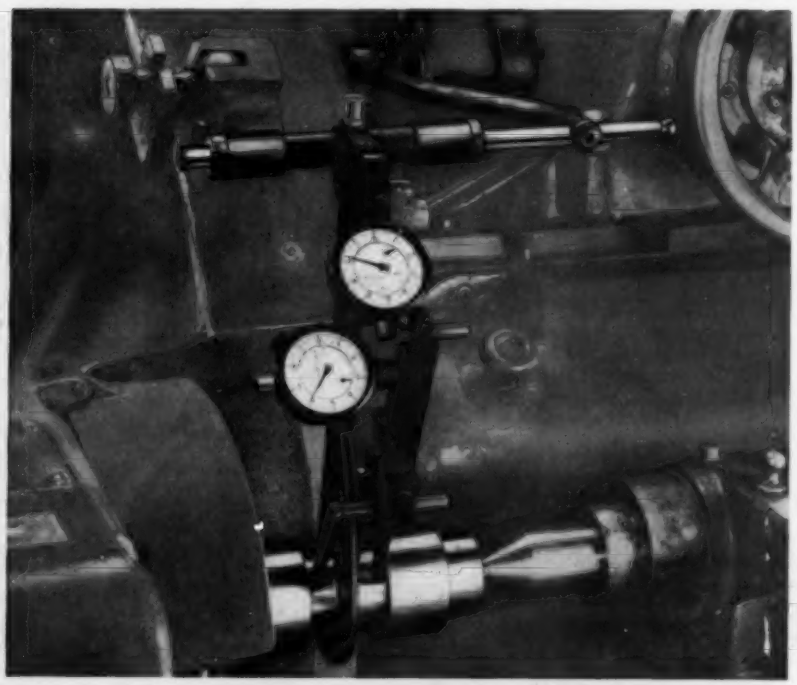




Use Model LWF for Inside Width and Diameter Gaging or for Outside Width and Diameter Gaging



These gages can also be air or electric operated and can be applied to automatic machine control.



The Arnold Grinding Gage is so frequently used to control the *diameter* of work on external grinders, its ability to gage a variety of other dimensions is often overlooked. You may be surprised to know that Federal Arnold Gages are regularly gaging *both inside and outside widths as well as diameters and simultaneously!*

Federal Arnold Grinding Gages assure maximum output per machine-hour, with *definitely less scrap,* less fatigue per man-hour — and better assembly, better performance and better production *at less cost per piece.* Catalog 55A shows other possibilities.

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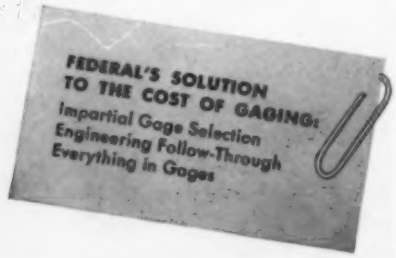

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Rusco ULTRA-SPEED is the ONE belt designed especially to withstand the tremendous centrifugal force of ultra high speeds AND the severe flexing action of small diameter pulleys. Extensive tests in the laboratory and in industry have proved that this lightweight, high strength belt outperforms all others. With Rusco ULTRA-SPEED, spindle speeds in excess of 100,000 rpm are not only possible but practical.

Manufactured by an exclusive Russell process, ULTRA-SPEED belts will not fray or shred—even when operated against a stationary steel bar. Here is resistance to edge wear that defies competition.

It will pay you to get the facts about Rusco ULTRA-SPEED—the new concept in high speed transmission belting. Fill out and mail this coupon today for detailed information.

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It should pay you too!

"Hill" Horizontal Spindle Grinder for a wide range of precision grinding. Made in table widths of 18", 24", 30" and 36" — table lengths from 5 to 20 feet.

"Hill" Vertical Spindle Grinder for rapid stock removal. Made in table widths of 18", 24" and 35" — table lengths from 5 to 20 feet.

Every manufacturer of heavy duty precision surface grinding equipment has:

- √ **Testimonials from satisfied users.**
- √ **Records of fine finishes produced.**
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But there are other important factors that should be considered:

- √ **Maximum accessibility and control simplicity.**
- √ **Minimum maintenance over the years.**
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It has always paid the users of HILL Open Side Hydraulic Surface Grinders. It should pay you too!

Look for the added considerations before you buy!

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"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

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Special Grinding Machines?

GRINDING AND FINISHING recently concluded a small survey to discover, in general numbers, the quantity of grinding machines industry planned to buy in the last half of 1956. While the results of this survey (which also embraces other questions) are of less interest to readers than to grinding machine builders one phase of the survey is worthy of study and contemplation: the keen interest in special grinding machines.

While the public prints are choked with data and developments on general special machine tools, special grinding machines have not received the attention from cost- and production-conscious executives which this primary metal removal method deserves.

The study involved only Michigan, Ohio and New York and covered all plants which received copies of GRINDING AND FINISHING. According to the survey, 10% of all respondents were interested in purchasing special grinding machines during the remainder of 1956. The average purchase per plant was 2.1 machines.

Using special grinding machines in industry is not new, we are all aware of crankshaft and camshaft grinders; however, these grinders were developed to grind a specific part, which due to its design, required special machines. We are more concerned in stimulating the use of special grinding machines on conventionally designed parts. One special machine has been developed which replaces 12 standard machines, six of which were vertical lathes. There is a great deal of saving here!

The automotive industry has been grinding tops and sides of blocks simultaneously on special machines immediately after being released from the foundry. This could be called special grinding of conventionally designed parts.

The 10% who plan to purchase special grinding machines reflect much advance thinking. While there are many problems which need to be solved by the builders and the suppliers (wheels, gaging, dressing, dust, coolant, etc.) the trend is toward specials wherever production and labor factors influence such choice.

Wm. J. Schleicher

Editor

on-the-job performance tests prove
IT PAYS to specify MACKLIN MM segments

A complete line of Macklin Segments provide fast cutting action without burring or checking. Fit any standard chuck.

Macklin MM Segments give better cutting action on hard-to-grind steels and carbides.

Here's Proof . . .

Macklin MM Segments increased production per segment wheel 127% in a large machinery manufacturing plant which surface grinds steel and cast iron machinery parts. Look at these figures . . .

	Macklin	Competitive Wheel B
Number of pieces ground per segment wheel	392	173
Segment life	13 days	6½ days
Dressings required	112 (in 13 days)	65 (in 6½ days)

Here are other typical MM Segment Performance test summaries:

Product	*Performance Record*
Cast iron table tops	Macklin MM Segments, 1000 pcs. Comp. Wheel B, 400 pcs.
Miscellaneous metal parts	Macklin MM life 2½ times greater than Brand C.
SAE 1335 heat-treated steel	Macklin MM removed as much metal in 15 hours as Brand B removed in 35 hours.

Here's why you get these results . . .

It's the unique MM construction consisting of a fine abrasive in pellet form which is engineered into MM Segments. This construction provides a constant flow of fine abrasive particles between the wheel and the work. The result? More metal removed per segment . . . fewer dressings required . . . and finer surface finishes.

But, don't take our word for it. Call your nearest Macklin distributor and arrange for a test on your own work. You'll be glad you did.

MACKLIN company

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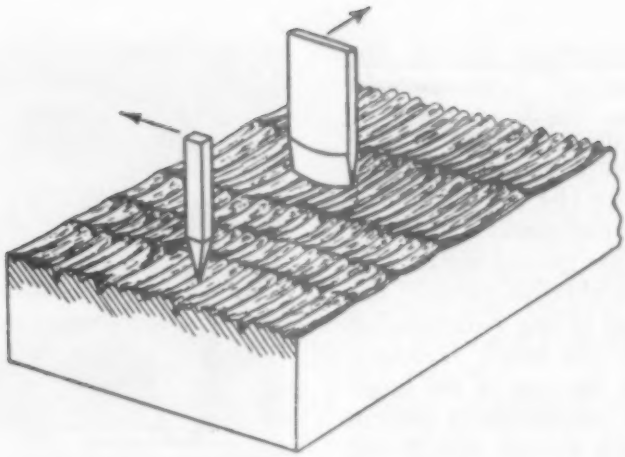


Significance and Measurement of

Surface Finish

Part 1

by **R. E. Reason,** Director of Research
Taylor, Taylor and Hobson Ltd.
Leicester, England

Beginning a thorough and timely three-part article based on the experience of one of the world's acknowledged leaders in the science of surface finish measurement.

Part 1 explores

- *The origin and nature of surface irregularities*
- *Product design considerations involving surface finish*
- *The stylus method of measuring surface finish*

In Part 2 the author continues his discussion of stylus instruments.

Part 3 will be devoted primarily to interference-type instruments.

The subject of Surface Finish has made such rapid strides during the last few years that it has become impossible to cover all the ground in the course of a single article.

On the topographic side, with which this article will be mainly concerned, the examination of surface irregularities so long and widely carried out by means of stylus instruments has been extended by the use of well designed interference microscopes and more recently still by the electron microscope, which is now revealing details not previously perceptible even to the interference instrument. On the physical side, the importance of the boundary layers and the part they play in determining wear and breakdown is becoming increasingly clear, and many pages could be devoted to this aspect alone.

Let us consider first of all, how the irregularities we have to talk about originate. In figure 1A we have a block which has been finished by shaping. Picture that the tool started at the back right-hand corner. It first takes a single chip from the surface, and **the surface texture within the groove so formed is determined by the way in which the metal has been torn away**—we may call the irregularities within the groove "rupture marks". As grooves are added by successive traverses there is built up what we call the machined surface, characterized so far

by the pattern of uniformly spaced grooves or "tool marks" and the irregular rupture marks within each tool mark. The planed surface (B) is very similar, except that the spacing of the tool marks is generally much greater. In the case of the ground surface (C) each chip is removed by an abrasive particle; the scratch marks lie more or less in one direction, but they are irregularly spaced, are much narrower, and are not continuous as in the case of the single point processes. Through a microscope, a pattern of rupture marks within each narrow scratch can again be seen. If we were to take the most finely lapped surface, with minutely narrow scratches caused by the finest diamond abrasive, we should still find within each scratch the rupture marks resulting from the way the individual chips had been detached from the surface by the diamond particles.

Notice in the first diagram two important characteristics—the crest spacing, which is measured horizontally along the surface, and what we call the height, that is the distance from the crest to the valley measured normally to the surface.

The first three diagrams display only the primary tool or scratch marks and the rupture marks which are indigenous to and characteristic of the process, and which cannot be escaped if that particular process is specified.

Now, in figure 1D, we see in addition, some secondary irregularities which ought not to exist. The grinding wheel has been badly trued so that its face is not parallel to the direction of traverse, and further, there has been some vibration, so that in the end elevation we see a sort of scalloped pattern (which may very easily resemble the pattern produced by the planing machine) while in the side elevation we see further scallops—chatter marks—caused by vibration. Neither of these superimposed secondary patterns would have existed if the machine had been set up and used properly. They represent waviness, the texture of defects.

If the slideways of the machine are perfectly straight, and the cutting takes place uniformly, all the major crests, whether of the tool marks in figure 1A, or chatter marks in figure 1D, will in any chosen section lie along a straight line; but if there are errors in the ways the line of the major crests will itself be curved; we call this an error of form.

Thus there are four basic types of irregularity which are generally listed in the order:

1. Errors of form.
2. Chatter marks and kindred defects (waviness).
3. The basic tool or abrasive marks.
4. Rupture marks.

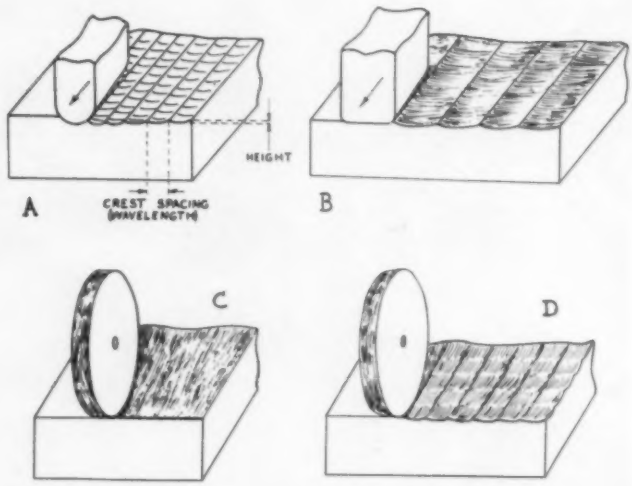


FIGURE 1

Now let us look at some typical surfaces.

In figures 2 and 3 we see a number of surfaces in plan, and in end elevation projected more or less from the plan. A point to be brought out is that because the height of the irregularities is generally very small compared with their own width, it is usual to magnify much more vertically than horizontally. For example, while the crest spacing will run from an inch for a planed surface downwards to a few hundred thousandths for the finest lapping, the height will run only from a few thousandths downwards to a few millionths of an inch, and in the case of rupture marks down to molecular dimensions.

In the first example, the height is magnified 400 times, but the crest spacing is magnified only 3 times (written 400/3). Further down, we go up to X 800/3, then 3000/150, and finally we have figures of 75,000 vertically compared with only 150 horizontally. An unavoidable consequence of this deliberate distortion is that the flank angles are grossly exaggerated. What appear to be deep valleys and sharp spikes are nothing of the sort. You will find that there are few flanks inclined to the surface by more than a few degrees, and often the flanks are inclined to the surface by no more than a fraction of a degree. That explains one aspect of how the stylus of a stylus instrument can get to the bottom of a scratch. The included angles of the scratches are generally quite large, and even a 90° stylus is very rarely beaten by flank angle.

Most of these diagrams—shaped, end-milled, roughly ground, finely ground, lapped—show nothing but primary texture, and in some cases the rupture marks with each tool mark. The diamond turned surface, however, shows very bad waviness, caused in this case by a defective slide rest.

Now, as we magnify the surface more and more, and examine it in finer and finer detail, we eventually reach—a little beyond the present range of even

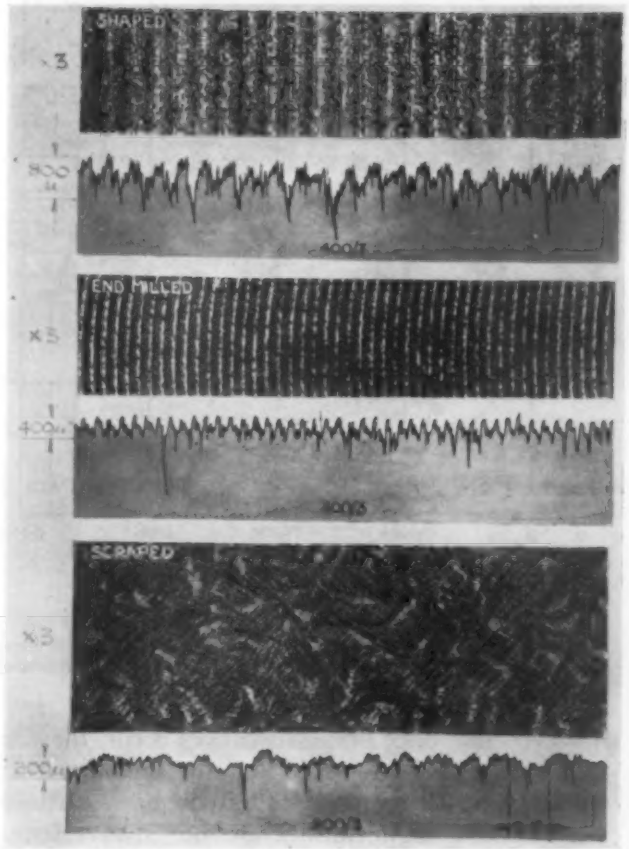


FIGURE 2

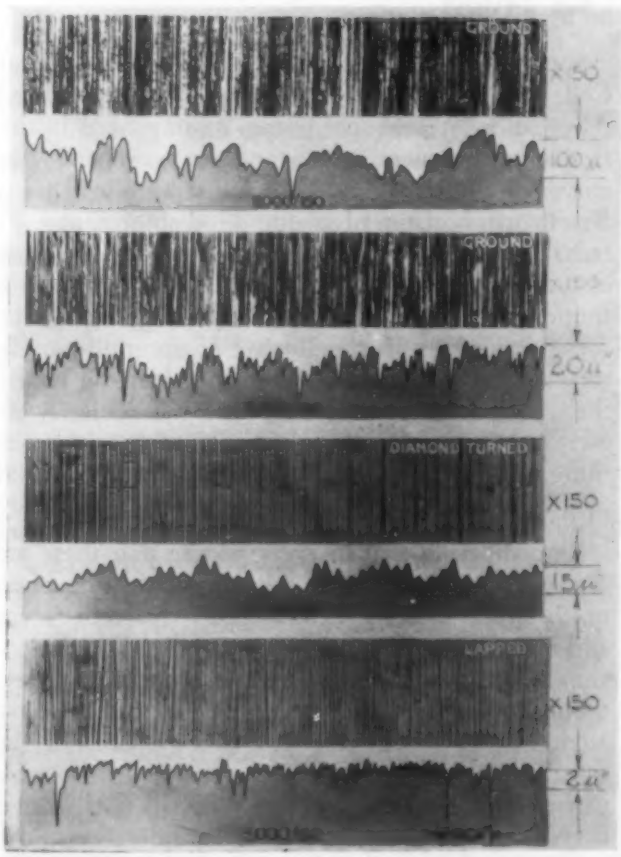


FIGURE 3

the electron microscope—the molecular structure of the material. The nature of this has to be studied indirectly by X-ray, electron diffraction and other methods. In this region we cease to think of topography. We must think instead of chemical and physical properties, and look to the pioneer work of Prof. G. I. Finch of Drs. Bowden and Tabor in Cambridge, and to the work of many others in England and America, for an understanding of the vital part these properties play in the story of friction and wear.

Professor Finch showed that most of the common engineering materials when exposed to the air form instantly, on the surface, a layer of oxide, and that the oxide film has exceedingly important properties in determining what happens when metal surfaces come into contact, as they do when lubrication breaks down. He showed further, how important transfers of material occur—for example a film of graphite appears on the surface of an aluminum piston working in a cast iron cylinder.

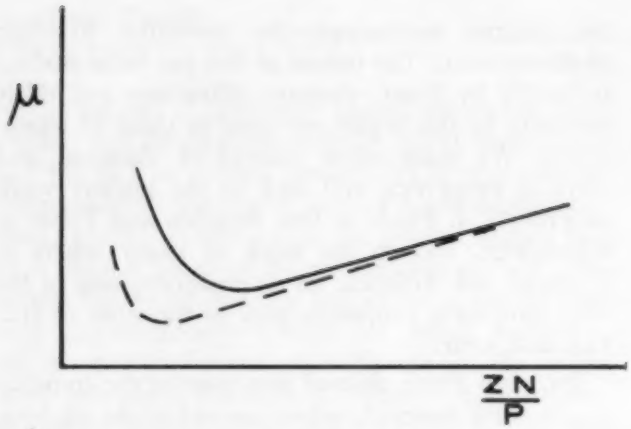
Engineers often talk about the 'bearing area' of surfaces. An intriguing experiment described in Bowden and Tabor's 'The Friction and Lubrication of Solids' showed how small the real area is, even with the best finished surfaces. Two clean lapped flat surfaces about 2" square, and two cylinders at right angles were each placed in contact under equal loads, and the electrical resistance between them was measured as an indication of the true area of contact. For a given load it was found to be about the same in each case; further it was proportional to the load.

Bowden explained that 'contact' means contact within molecular dimensions. A gap of even a millionth of an inch is no contact. When the surfaces slide on one another, high temperatures develop at the points of contact, and a form of welding occurs. If motion is to continue, these welds must either shear in the plane of sliding, or a particle must be plucked out of one surface or the other. The integration of these forces is about equal to the force of friction. Thus the laws of friction, that the force is proportional to load, independent of error, and not greatly dependent on surface finish, are explained.

Finch showed how the oxide film 'necking' a weld could help it to shear harmlessly in the plane of sliding.

The high temperatures occurring at the points of contact account for the behavior of the high pressure additives which are put into lubricating oils—phosphates and sulphur compounds and so on. At high temperatures these compounds dissociate and combine with the metals to form protective films which help to prevent actual metal-to-metal contact from occurring.

Physics and geometry are often united by the



▲ FIGURE 4

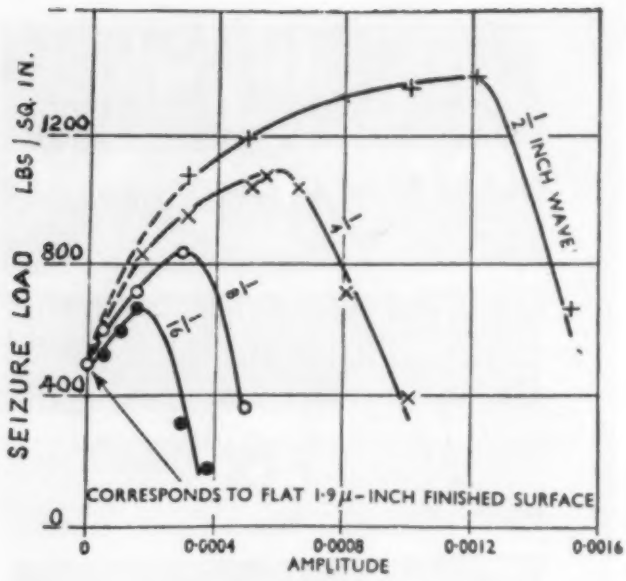


FIGURE 5 ►

Surface Finish

continued

familiar curves shown in figure 4, in which the co-efficient of friction M of a sliding pair is plotted against the dimensionless parameter ZN/P, Z being the viscosity, N the speed and P the load. The co-efficient of friction M is of course the force of friction F divided by the load P, so that if we keep the load and viscosity constant the resulting curve describes simply the frictional force F plotted against speed N.

Imagine that a slider has been at rest for a time so that all the oil has squashed down sufficiently for the high spots to have come into contact, and that the slider is then pulled along by a force F. The initial force will have first overcome the dry friction and will be high. It accounts for the starting jerk—the stiction—with which all engineers are familiar. As the speed is increased, it is found that the force F falls, for although high spots are still in contact, there comes into play what is called boundary lubrication—lubrication by oil and other films of molecular thickness. Eventually the curve flattens out and a minimum value of F is reached. At this point the lubricant begins to have a lifting effect, and there is only intermittent contact between occasional high spots. As the speed is raised still further, the oil film acquires a finite thickness, contact ceases and there is full hydrodynamic lubrication. Yet further increases in speed serve only to increase the force F and the thickness of the oil film.

Surface Finish has little part to play when there is a full fluid film. It comes into the picture as soon as contact begins. Improvement in finish lowers the minimum value of F and sharpens the toe of the curve, because with better finish, thinner hydrodynamic films are possible. Experience has shown, however, that once breakdown does occur, the consequences may be more serious for smoother than for less smooth surfaces. This may be one reason why initially high finishes are not always found best. In the neighborhood of contact, the direction of the scratch marks—the lay—can have an important effect on the flow of oil, and criss-cross patterns such as are often produced by honing may be highly advantageous.

Some interesting work done in the Manchester College of Technology by Salama and others showed that sliding at low speeds can be improved by introducing waviness on one of the members. The curves in figure 5 show how the seizure load for a flat thrust bearing of about 7″ diameter and 1″ radial width varied with amplitude for a number of wavelengths. In each case the best amplitude was found to be about 1/400th of the wavelength. The introduction of a half-inch wave of optimum amplitude (.0012″) increased the seizure load by nearly three times. Salama showed that the results were consistent with the supposition that the waves permitted the build up of oil wedges after the fashion of a Michell or Kingsbury bearing.

Remembering that in every sliding pair there are always two surfaces to be taken into account, often of different materials finished in different ways, and that the important thing may be the relationship of their finishes rather than the details appertaining to either surface considered by itself, I have attempted to summarize and display some of the significant factors in the story of wear in the table in figure 6. You will see what a small part of it is curved by purely geometrical considerations—our main topic for this article.

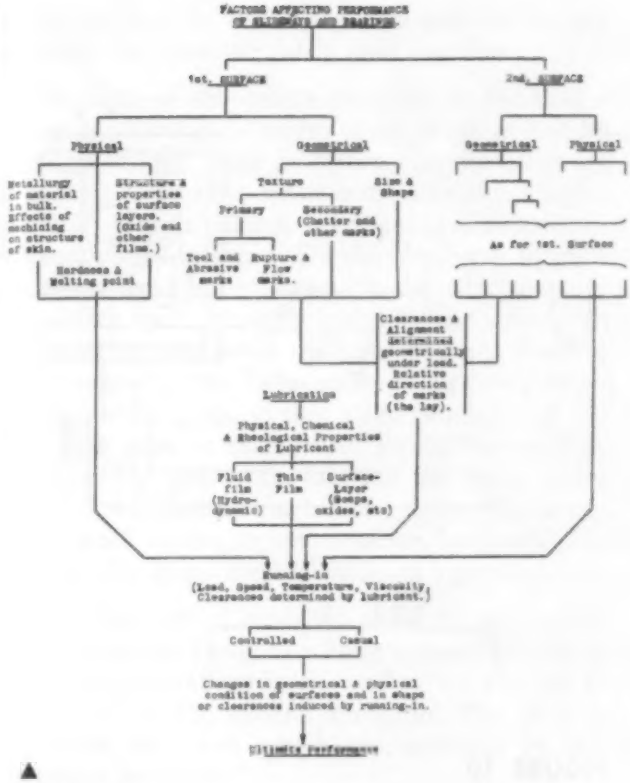


FIGURE 6

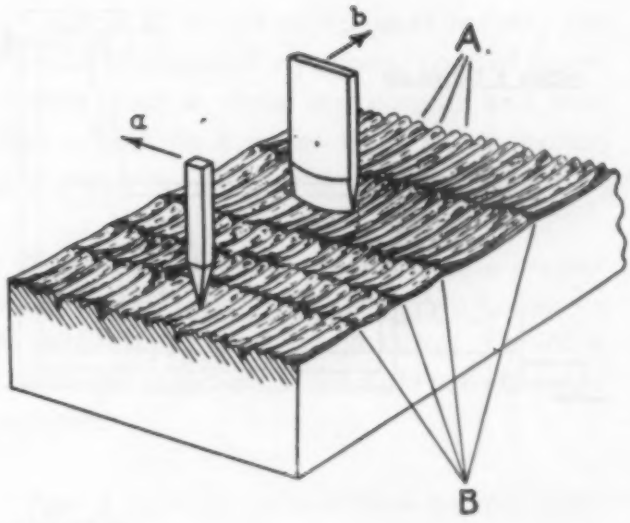


FIGURE 7

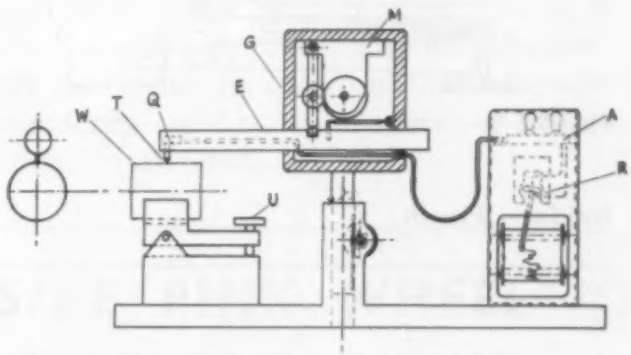


FIGURE 8 ►

We must get into the main subject of the article, which is the way in which the geometrical irregularities are to be measured and assessed. There are a great many methods used, but this article will concentrate on the stylus method and the interference method.

In figure 7 we see a ground surface with some chatter marks on it which has to be measured. For measuring the scratch marks produced by the grit we use a sharp stylus which is traversed across the surface at right angles to the direction of the scratch marks. A practical stylus will have a tip dimension of about one ten-thousandth of an inch square or one ten-thousandths of an inch radius. Such a stylus is found to get to the bottom of most of the major scratch marks produced on ground and even on lapped surfaces. Of course there are many narrower scratches which the stylus will not satisfactorily explore, but the bulk of the scratches in which the engineer is interested seem to be of greater width than .0002", and therefore the stylus is an acceptable tool.

For measuring the chatter marks it is better to use a hatchet-like stylus which, running down the length of the surface, will reveal the chatter marks without penetrating into the scratch marks which might otherwise confuse the representation of the chatter marks.

Fig. 8 shows a diagrammatic stylus instrument. The stylus T actuates in this case an electrical transducer Q, a device producing a current or voltage according to displacement, which is carried in the end of a motor-driven sliding shaft E. The up and down movements of the stylus as it passes over the irregularities are measured relative to the path followed by the shaft which must therefore be of very high order of perfection. The output from the transducer is amplified and sent into a pen recorder, which plots the shape of the profile of the irregularities.

Such a slideway presents problems, because it needs to be accurate to a millionth of an inch or so, and although that can be achieved in the laboratory it would be a little difficult to maintain in industrial surroundings.

Attempts have therefore been made to side-step the problem. In Model 2 Talysurf we used a straight

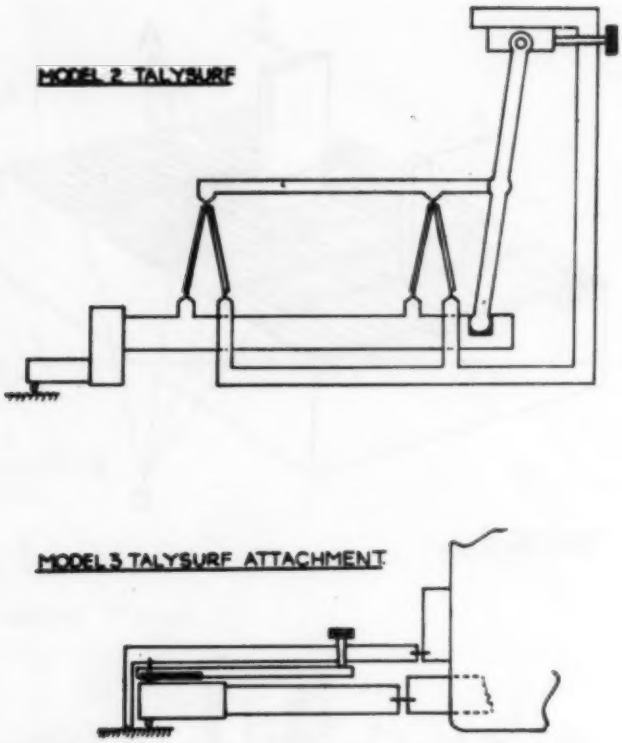


FIGURE 9

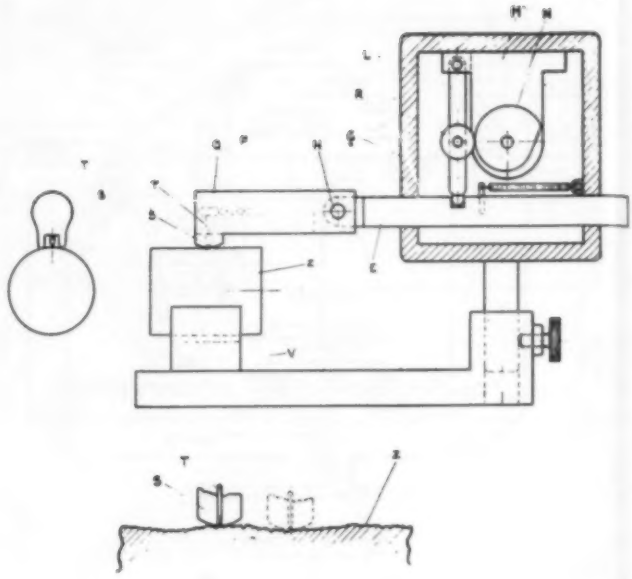


FIGURE 10

Surface Finish

continued

line linkage, figure 9, having ligament hinges which produced very accurate movement and of course went on being accurate provided the hinges were not damaged. However, it proved rather expensive to make, and more recently we have tried the device of mounting above the surface and parallel to it an optical flat, which is engaged by a little button on top of the pick-up so that the instrument, in effect, gages the variation in the gap between the optical flat and the surface to be investigated. With both these devices, the direction of traverse has to be adjusted for each specimen to make it parallel to the general direction of the surface being checked, in order to keep the graph on the recording paper of the instrument. This labor can be obviated by the very well known device of mounting a skid on the underside of the pick-up to slide along the surface itself together with the stylus.

While the linkage and the slideway provide an absolute datum, the skid on the surface provides only an approximate datum which, however, is often good enough for practical purposes.

Figure 10 shows how the skid pick-up is hinged at H to the driving bar E which now constitutes little more than a device for pulling the pick-up along the surface. The rounded skid S which rests on the surface is assumed to slide over the crests of the irregularities without sinking appreciably into them. What we measure is the difference in vertical movement between the skid and the stylus T. If the waves are far apart of course the skid will follow them and we shall not be aware of their presence in the final

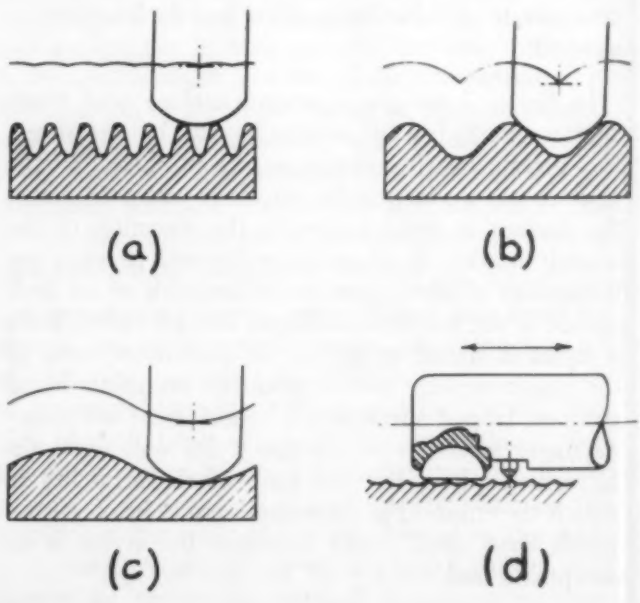


FIGURE 11

results, so that the device is useful only for texture of which the crests are fairly close together.

The shape of the datum provided by the skid is that of the locus of its centre of curvature as it slides over the surface. Thus in figure 11a, the crests are close together and the datum is substantially straight; in figure 11b, the datum is becoming distinctly deformed, whilst in figure 11c the spacing is so great that the datum has substantially the same shape as the surface itself. Nevertheless, since the stylus does not touch the surface at the same point as the skid it is possible for the stylus to be going down when the skid is going up, so that a representation of the surface, or even an exaggerated representation, may be obtained in spite of the fact that the skid is going up and down quite as much as the stylus. We do not like to work in this region, however, because of the uncertainties as to the real scale of magnification.

For widely spaced crests we prefer to use another device, shown in figure 11d. Here a shoe slides along the surface, swivelling in the end of the pick-up to align itself to the general direction. The shoe is serviceable for crests which are separated by not more than its radius.

End of Part 1.

In Part 2, appearing next month, Mr. Reason discusses the various types of transducers used in stylus instruments and how they affect the translation of stylus motion into meter readings and recorder graphs.

Entering into this discussion is the proper selection of roughness-width-cutoff, known to the British as wave-length cutoff. Valuable tips on the selection of the right cut-off value are given.

Part 3 contains information on the interference method of finish measurement, becoming increasingly valuable because it can resolve scratches 20 to 30 millionths of an inch wide under production conditions. It also includes very practical on-the-job pointers on the use of instruments, reference standards—and common sense—in measuring surface finish.

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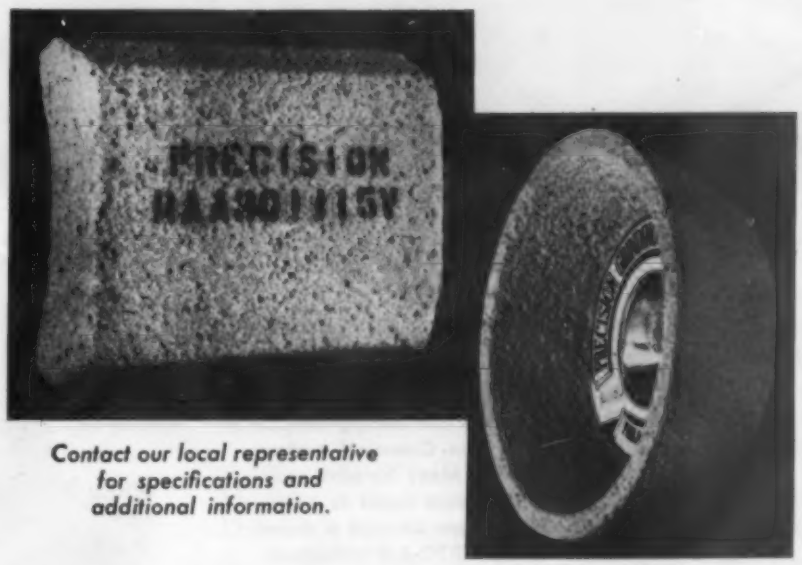

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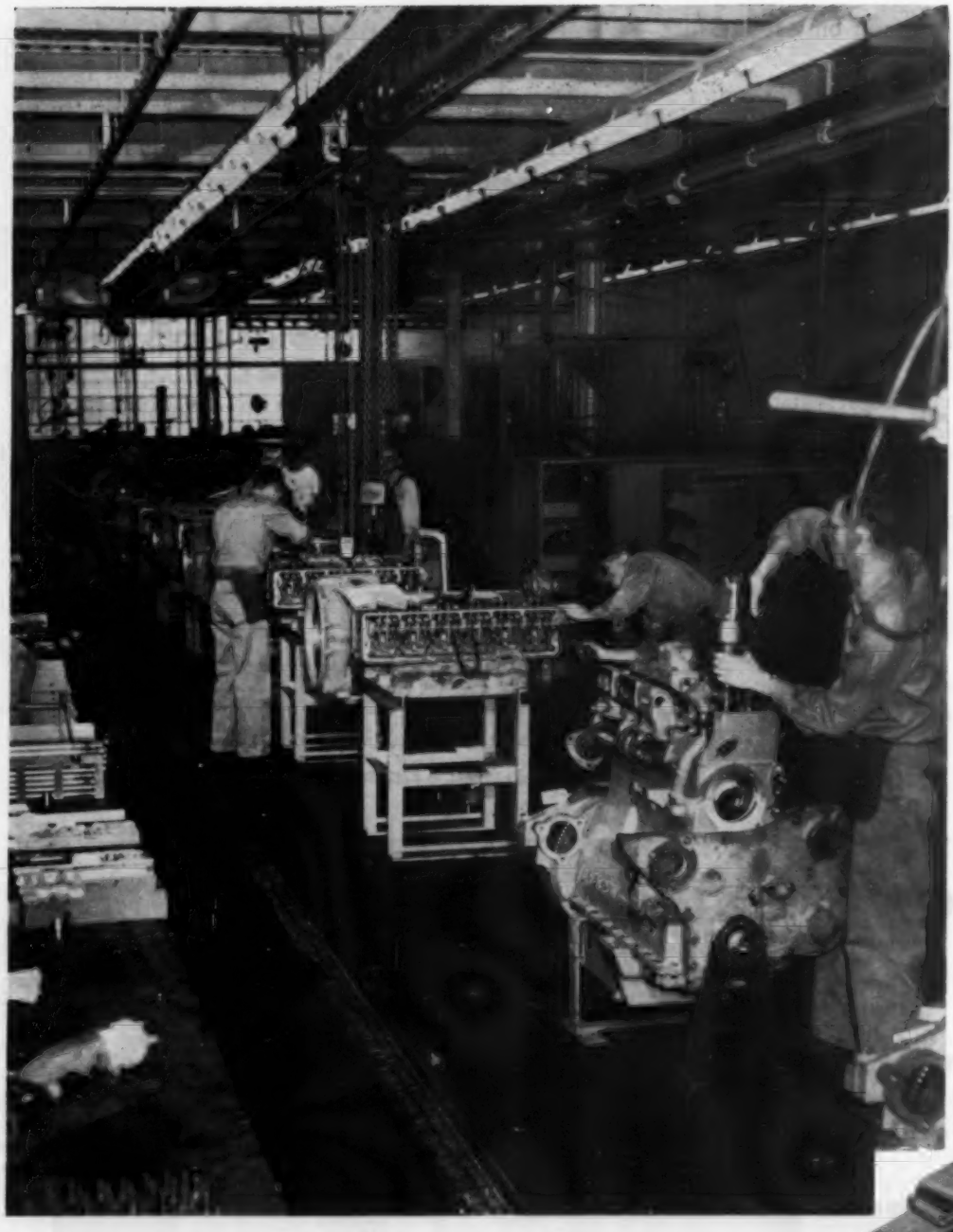


CUMMINS HIGH-SPEED DIESELS coming off the final assembly line, above, in Cummins' modern plant in Columbus, Indiana. Many abrasive operations on the engine parts were found to be interesting and are presented here. At right is shown the 335-horsepower model NRTO-6-B turbodiesel.

Outstanding Abrasive Operations on

Cummins Diesels

by **Jack Kenyon**
Managing Editor

Cummins Engine Company, Inc., Columbus, Indiana, leading independent builder of high-speed lightweight diesel engines used in trucks, earth-moving equipment, boats, oil drilling rigs, irrigation pumps and numerous other applications, show real leadership in processing methods as well as in engine design.

Abrasive operations play a prominent part in precision manufacturing methods of Cummins diesel parts. In our visit to the Cummins plant in Columbus we saw a number of operations which should prove of interest. Some techniques have been developed by Cummins engineers for their particular processing requirements, but can be readily applied elsewhere.

Noteworthy to us is a general trend at Cummins of pulling in operations which have been previously done outside the company. Camshaft machining facilities, for example, are new, and though the incomplete facilities are turning out only a token number of shafts as compared with Cummins' total production requirements, their operating personnel are gaining experience which will be very valuable as in-plant production is increased.

We appreciate the very fine co-operation of W. H. Adams, Supervisor of Injector Manufacturing; Dale Hall, Supervisor of Fuel Pump Manufacturing; A. S. McCollum and Earl Borseth, foremen; and others who assisted in preparation of this coverage of Cummins operations.

ROUGH AND SEMI-FINISH GRINDING of the fuel injection plunger OD are done on this Cincinnati centerless. Stock removal has to be watched very closely in every operation of the grinding sequence to prevent troubles with finish, size, taper, etc.

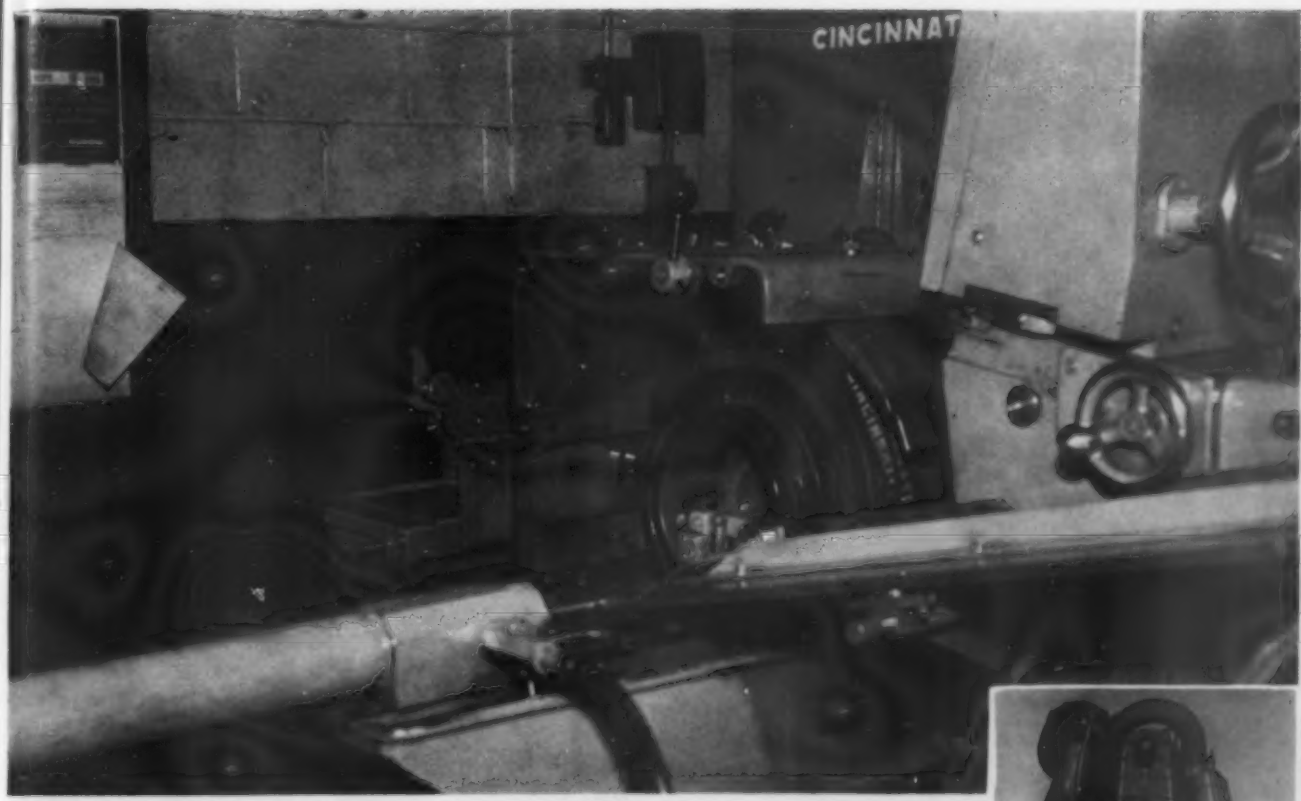
CUMMINS

Grinding Operations—Fuel Injector Plunger

Standard centerless operations . . . an outstanding example of centerless plunge groove grinding . . . and good application of centerless lap grinding . . . all contribute to provide necessary precision in this vital component of the Cummins fuel injector.

Accurate metering of the engine's fuel charge and proper injection of the charge into the cylinder is largely dependent on the fit of the plunger in the fuel injector body and on other related factors involving surface finish of the mating parts and accuracy in location of the plunger's ground grooves and its point angle. To insure maintaining the specified .0002-in. minimum clearance fit of the plunger in its mating body, four classifications of bodies and plungers have been set up, for each injector model, with a .0001-in. difference between classes. But grinding of the plungers to fit these honed bore classes doesn't follow the usual concept of selective assembly after inspection. Plungers are accurately ground as "zeros", "ones", "twos", and "threes" and held within plus or minus 20 millionths of nominal size for each numbered body size. In this way true interchangeability is assured and every "three" plunger made by Cummins will properly fit any "three" injector body.

Plungers, made of Air Die 225 steel, are initially rough machined on automatics from ground stock, then heat treated to 62-64 RC. Heat treatment warpage may run as high as .005-.006-in. The material has presented some difficulties in grinding.



PLUNGE CENTERLESS GRINDING of two critical grooves and roughing of the point angle is done on this No. 2 Cincinnati centerless, shown here with wheel guard removed. The three form-dressed wheels are run at 9500 sfm for the operation.

175 HP CUMMINS MODEL JT-6-B DIESEL

First grinding operation on the part is centerless rough grinding of the OD, done on a Cincinnati No. 2. Stock removal runs a total of about .010-in. for three passes. As Cummins foreman A. S. McCollum put it, "We have to watch stock removal closely on each operation in the 15-pass sequence. If we don't, we may have trouble with finish, size, taper, obtained all along the line."

Wheel for rough grinding is an A80-J13-V, and coolant is Vantrol 5615. Surface speed for the operation is 6500 sfm.

Following rough grinding, the plungers are returned to heat treat for stress drawing.

Semi-finish grinding, which removes another .003-in. stock in three passes on a Cincinnati centerless grinder, is done with the same wheel as roughing. This operation holds size and taper within limits of .0003-in.

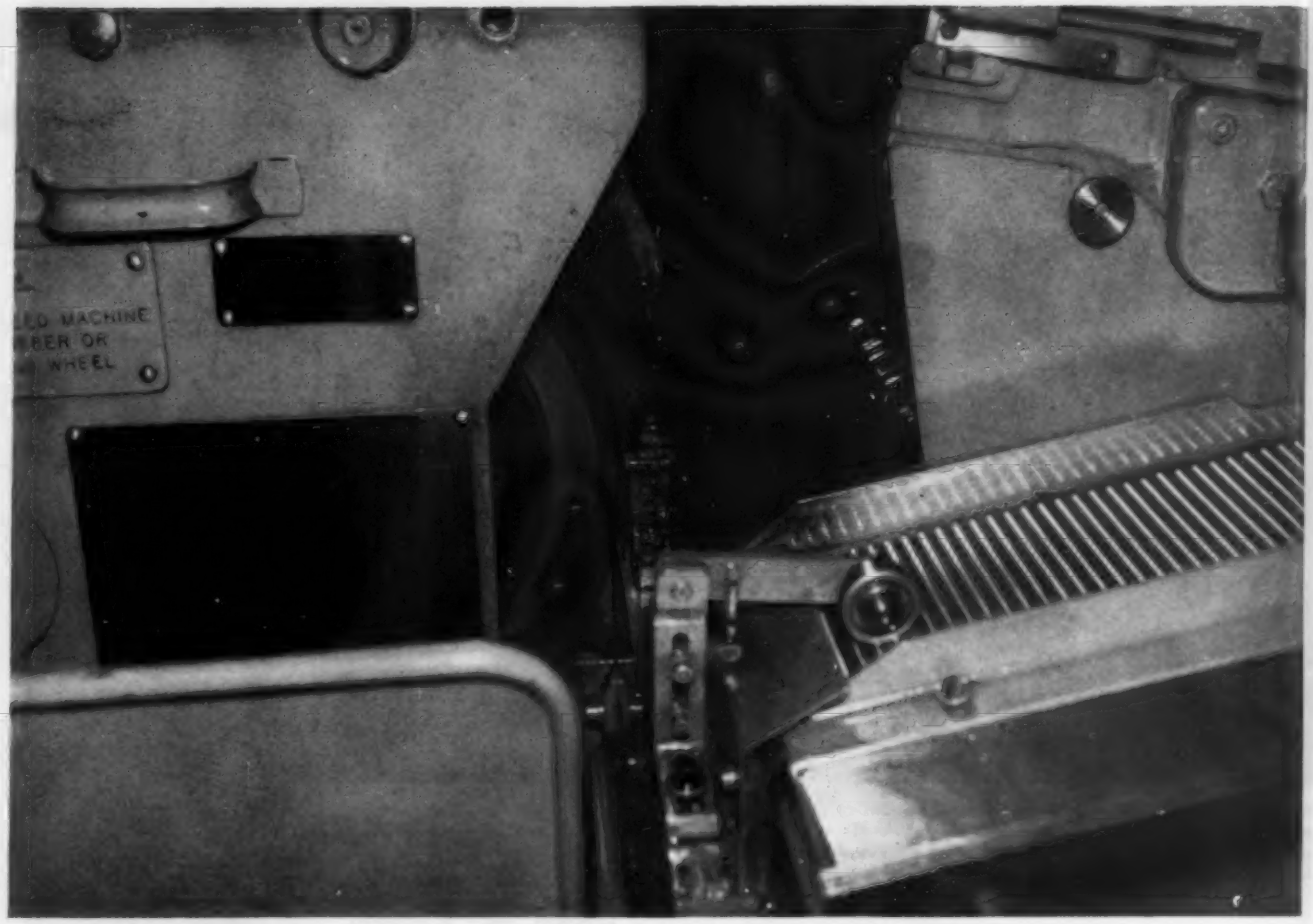
Plunge Grinding Grooves and Point Angle

Finish grinding of two grooves and roughing of the point angle is then done by plunge grinding with a special three-wheel setup on a Cincinnati No. 2 centerless, in a very interesting operation. The three wheels are 20-inch diameter A80-R9-B's, and surface speed is 9500 sfm. The coolant for the high-speed operation is Transultex-B.

Loading of parts for the plunge grinding operation is done automatically. Before grinding begins, the reverse taper on the machine's regulating wheel locates the plunger accurately against a stop. This is important for axial positioning of the part, since the distance between the point and the metering groove (one nearest the point) is critical. Dressing is done automatically by means of a special dressing cam which controls the single point diamonds.

Lap grinding the plunger OD on a Cincinnati centerless is the next plunger operation. This operation is the one which must control final size of the part to fall within specified limits of the various classifying ranges. The 14 x 22 x 6-⅜ wheel used is an A180-Q10-V, while the regulating wheel is a C 320 VBX. Coolant for this operation is Microgrind soluble in a 35-1 mixture. Stock removal is very slight.

Finish grinding the point angle is next done on a Brown and Sharpe single wheel mounting a 7-⅛ inch diameter wheel, A 80-M8-V. Angle accuracy is closely held to 45°, minus 2 min., plus 0, for proper performance of the plunger in the injector.



FULL AUTOMATIC PARTS LOADER for the plunge-grinding operation takes parts down chute and inserts them for operation by air cylinder action. Coolant is Transultex-B.

CUMMINS

A mixture of paraffin oil with No. 10 Seraco base oil is used as a grinding fluid.

Inspection follows grinding of the point. Location of the metering groove with respect to a gage diameter on the point angle, size and concentricity of the angle, and length and runout of the entire plunger are all checked 100%.

Triple-A lap grinding, a final finishing step on the plungers, is done on a Cincinnati centerless, using a 14 x 22 wheel, C-500-B. This obtains a 3 microinch maximum finish—Cummins reports that finish usually runs about 1-½ micro in actual practice—without appreciable stock removal.

A final inspection of the parts, mainly to insure adherence to size classifications for the four injector body sizes, is done next.

Cummins engineers indicated that ideal practice would be to grind plungers to match the batches of injector bodies as they come from honing, since it is possible to hold the plungers easily to the necessary accuracy. But variations in the bores are of such a random nature that it has been more practical to provide banks of plungers of each classification to meet production demands.

Oversize body and plunger classes for service work have been standardized to eliminate necessity of grinding a great many sizes of plungers, so that for any one model injector there are 12 possible sizes of plungers—two standard service sizes for each of the four classes in addition to the original production sizes.

LAP CENTERLESS GRINDING establishes final size of plungers, which must be held within 20 millionths of nominal size.

CUMMINS HAS BEGUN PILOT production of the camshaft for one of its 200 horsepower diesels in the Columbus plant; camshaft work was formerly done on the outside. Here is grinding of the injector cam lobe, done on a 10-inch Norton CTU.

Injector Lobe Grinding

on the Cummins camshaft is an exacting operation

180 HP CUMMINS MODEL HRFB-600

Cummins has begun pilot production of the camshaft for the Model NH-600, 200 horsepower diesel in the main plant in Columbus, looking to the time when all camshaft work may be under their own roof. Interesting among operations being done at Cummins on the Model NH-600 camshaft is rough and finish grinding of the six injector cam lobes, done on a 10-inch Norton CTU cylindrical grinder, equipped with master cams made to Cummins specifications by Norton.

The camshaft is an SAE E-1019 steel forging which is rough turned on a J & L Faymatic camshaft lathe prior to grinding. Cam lobes are hardened to 58-62 RC. Injector lobes, with a maximum lift of .134-inch, are quite wide, actuating a wide-face follower which operates the diesel fuel injector cycle for each cylinder.

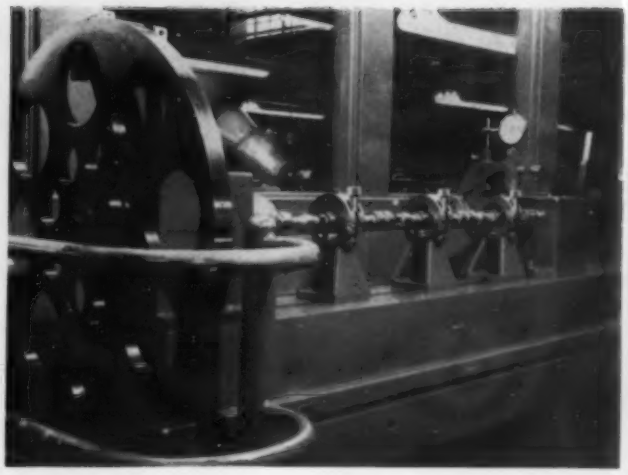
A fixture pin in the live center aligns with the No. 1 hole in the shaft flange, and three steady rests are used for both roughing and finishing. Approximately .035-in. stock is removed by the roughing wheel, an A 54-J8-V, operating at a standard 6500 sfm. Feed is .035-.040 inches/min., workpiece speed is 17 rpm.

For finish grinding, the wheel is changed to an A80-N-B, and stock removal is .003-.005-inch. Finish requirements run finer for the injector lobes than for the valve lobes; injector lobes must be less than 10 micro. Tolerances on timing points for various parts of the cam profile have a slight variation, ranging from .002-in. to .004-in.

Dressing by means of a single point diamond is

done once for every shaft on roughing, once every two parts for finishing.

100% inspection of shafts follows processing, and includes magnafluxing and elaborate dimensional checks. Magnafluxing is done primarily to check for heat cracks, following which the shafts are placed in a special checking fixture with a timing-point wheel made by Vinco and carefully aligned. In the checking fixture the shaft is rotated and each lobe indicated for timing and contour. Here bearing size, location, and runout are also carefully checked.



CAMSHAFT CHECKING for timing points is done on a 100% basis on this special checking fixture with Vinco timing wheel.

CUMMINS

Precision Barrel Deburring

lowers costs on many engine parts at Cummins

Among barrel finishing operations which are contributing materially to cost reduction and improved quality of deburring at Cummins on a variety of parts are two being performed by a twin Rampe barrel machine. The unit has two 3-compartment barrels of two cubic feet capacity each, which handle aluminum or cast iron small parts unfixtured, using Crown Iron Works No. 2 triangular aluminum oxide ceramic chips.

Typical of parts now being deburred by the Rampe unit is an aluminum fuel pump body on which the former production rate using hand methods was 15 per hour. The part is now deburred in a 25 minute barrel cycle, and results are more uniform than with hand methods. Annual cost savings are estimated at $5000.

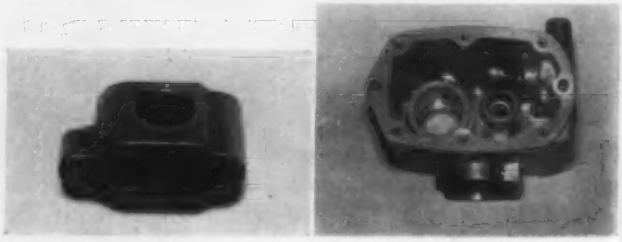
Another part which is run in the twin-barrel setup is a cast iron rocker shaft bearing, on which an internal burr from a broaching operation must be removed. The burr was very difficult to reach by hand tools, and consistent results were not obtained; dramatic cost savings have resulted from the use of barrel methods for the part.

Compound for both these operations is Mechanical Finishing Co. ATB-99, which is run for eight hours before changing.

Connecting Rod Deburring

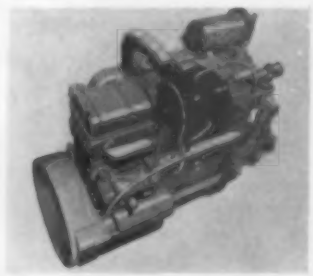
Another interesting barrel finishing operation is deburring completely machined connecting rods for all but the very largest Cummins engines. The connecting rod operation is performed by a pair of D. J. Murray machines processing as many as 800 rods in three shifts.

Six rods are loaded loose in each compartment of the four-compartment rubber-lined barrels. The chips are Minnesota Mining size No. 3 Super Honite.



BARREL DEBURRING has accomplished some remarkable economies at Cummins. Left, foreman Earl Borseth indicates fuel pump body deburred in twin Rampe machine in background. Same part, below left, shows thorough action in interior of casting. Below right, cast iron rocker shaft bearing run in same barrel, on which internal burr from broaching operation must be removed.

CONNECTING ROD DEBURRING IS handled in two of these D. J. Murray barrels, which process as many as 800 rods per shift, loaded six at a time in each compartment for a 40-minute run. Completely machined and assembled rods are finished as shown above.



175 HP CUMMINS JT-6-B DIESEL

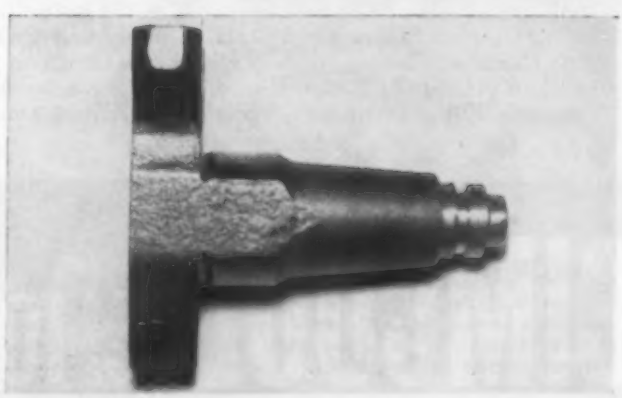
The rods are finished in a 40 minute cycle. Compound is a 50-50 mixture of Minnesota Mining 1125 Grease-Cut compound and Honite 301 by Mechanical Finishing Company, Cincinnati. The compound is changed every fourth load, and chips are screened about every two weeks to eliminate small fragments that could lodge in small holes in the rods.

Occasional slight nicking of the bronze crankpin bearing insert is the only difficulty encountered in the barrel operation, according to Cummins operating personnel, and its effect is so slight as to be negligible.

In Planning Stages . . .

Interesting jobs planned for the near future at Cummins include a series of three combination grinding operations to be done on this turbocharger turbine wheel and shaft assembly, upper right. Stellite wheel on a stainless shaft has presented its problems, but Cummins plans to attack it with multiple angled form wheels on a Landis grinder now on order. Among difficult aspects of job is grinding concave form in stellite vanes, which requires stock removal in neighborhood of .170-inch per vane.

Another operation planned by Cummins is multisurface job in which the forged steel fuel injector body at right will be form ground by Sheffield grinder using crush trueing of wheel form. Operation previous to grinding is rough turning on New Britain tracer lathe.



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CIMCOOL	**Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.
CIMPLUS	The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.
CIMCUT	**Base Additive**—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.
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CIMCOOL Cutting Fluids

for 100% *of all metal cutting jobs*

PRODUCTION PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

GRINDING safely

● The use of abrasive cutting-off wheels is about as old as the entire range of abrasive wheels. Modern cutting-off wheels are very strong, operate at high speed, and under proper conditions are quite safe to use.

Thin cutting-off wheels are frequently requested for use on a regular woodworking circular saw table. This is very undesirable. Speed is usually high, and flanges are of inadequate size and improper design for the purpose. Provision for endplay in the shaft is seldom good enough for the requirements of abrasive cutting, and the means for controlling the plane of the work traverse is poor. Last but most important, the matter of a protection hood is usually overlooked entirely.

The widespread use of cutting-off wheels without injury to workmen has helped create the general impression that such wheels are so safe as to be foolproof. As a matter of fact, the true factor for safety in such wheels while operating at the usual cutting-off speed is frequently less than in other classes of grinding wheels operating at their normal speeds. The reason for this is that the whole efficiency of the modern cutting-off grinding machine depends upon high wheel speeds, and many wheels in use today are simply not strong enough to be tested at speeds 50% higher, as is customary with other types of wheels.

This need give no cause for alarm, however, when the cutting-off wheels are used in equipment which is properly guarded. Wheel breakages happen, but with proper guarding no one is hurt, and outside the loss of the wheel, no one is much concerned about an occasional wheel breakage.

Thus, instead of saying that cutting-off wheels are perfectly safe, it would be much more accurate to say that abrasive cutting on modern high-speed cutting-off machines is a perfectly safe operation. The use of the same wheels at the same or even lower speeds on a circular saw table might be very dangerous indeed.

Abrasive cutting is largely hand fed, and the heavy tonnage of production is in dry cutting. In the typical chopper type machine, the wheel is sunk into the work by the weight the operator puts on the handle, and efficiency depends very largely upon the operator's experience and judgment. Too light a feeding pressure causes the abrasive to glaze and discolor the work; too heavy a pressure causes the abrasive grains to bed too deep and be torn out of the wheel before they have done their work. The happy medium is up to the operator, who must be familiar with the sound and feel of the work, which depends on the rigidity of the machine, the character of the work being cut, the efficiency of the hold-down mechanism, and other variables.

WRONG . . .

LACK OF PROPER EYE PROTECTION for a very high speed operation using a cutting-off wheel coupled with improper tightening of the work holding fixture can make this job hazardous. High speed cutting-off wheels are well guarded, and in the event of wheel breakage there is little real hazard for the operator.

RIGHT . . .

FACE SHIELD is on the man instead of dangling from the grinder stand, and work holder is properly tightened down so that jar or vibration will not bounce the bar around and cause possible wheel breakage. Signs posted on equipment by shop safety committee indicate a high degree of respect for this equipment.

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12" 2 HP — $1985.00

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hand feed precision surface grinder!

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Our new illustrated catalog tells all . . . all about Abrasive's effortless anti-friction roller ways; totally enclosed motorized spindle; new, chatterless cable table drive (successfully tested for over 1,000,000 quick reversals); convenient, waist high table and elevating hand wheels; deep, heavily-ribbed saddle; optional 12" or 7" wheel head; and how you can have the elevating and table hand wheels on either right or left.

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ABRASIVE

Machine Tool Company

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ABRASIVE
ACCURACY BOOSTS PRODUCTION

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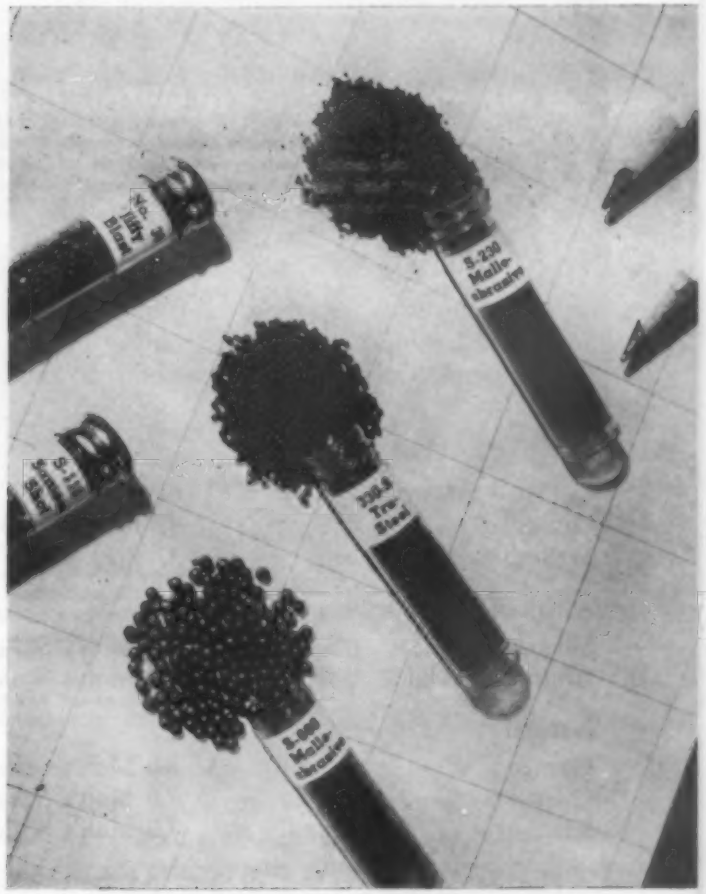
If you're going to blast clean—

Use the Right Abrasive

by **Victor F. Stine**
Vice President, Engineering
Pangborn Corporation
Hagerstown, Maryland



ABRASIVE MEDIA FOR BLAST CLEANING of metals include the various types of metallic shot shown, as well as other artificial, natural and agricultural abrasives. Selection of medium for a particular job depends on metal to be cleaned, shape of part, kind of material removed, and desired finish.

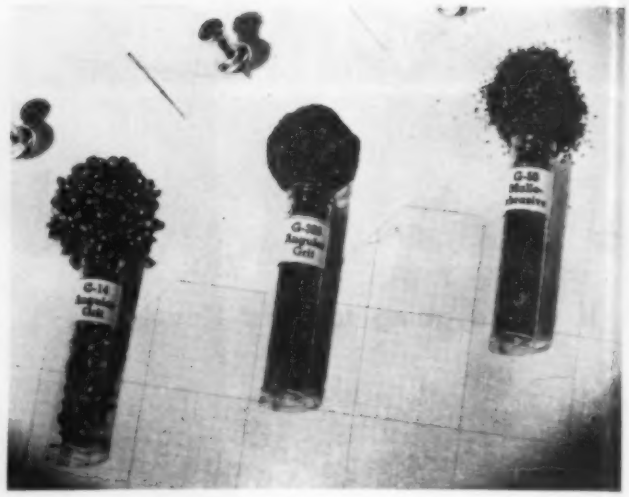
Of the many types, sizes and shapes of abrasives available, there is always one which will blast clean a particular part better, faster and more economically than any other. Primary factors to be considered in selecting the correct abrasive for a particular job are: (1) the type of metal to be cleaned, (2) the shape of the part, (3) the kind of material to be removed, and (4) the surface finish desired.

Metals that are blast cleaned range from toughest armor plate and cast iron to soft aluminum alloy and vary in size from locomotives to dental drills. Surface coatings ranging from burnt-in sand to thin oil film can be blasted to produce effects ranging from deep abrading to gentle wiping. To cover this wide range of cleaning requirements, blasting equipment manufacturers have developed a nearly equally-wide range of abrasives.

The first step in choosing the correct abrasive is to find out what abrasive materials there are to choose from and the effects these materials have on the cleaning action. The second step is to consider the shapes and sizes of the abrasive particles and the effect of particle dimensions on the cleaning action. Third step is to consider what would be the cost (abrasives and labor) per square foot of cleaning. The cost factors would be: (a) the cost of abrasive, (b) time requirements, (c) the possibility of abrasive recovery, and (d) the cost of dust suppression. Finally, it will be helpful to review typical specific applications of the various abrasives and the reasons for their choice in each case.

ABRASIVE MATERIALS

Abrasive materials fall into four groups: metals, chemical compounds, natural compounds and agricultural grits. The material determines the hardness, absorbing ability, cutting ability and deterioration tendencies of an individual particle. The most commonly-used abrasives are listed in Table 1. The hardest material in each group is listed at the top



ABRASIVES SOFTER THAN THE METAL THEY clean can remove material without substantially changing the dimensions of the metal. Grit abrasive, as shown here, both hammers and cuts the surface it is cleaning.

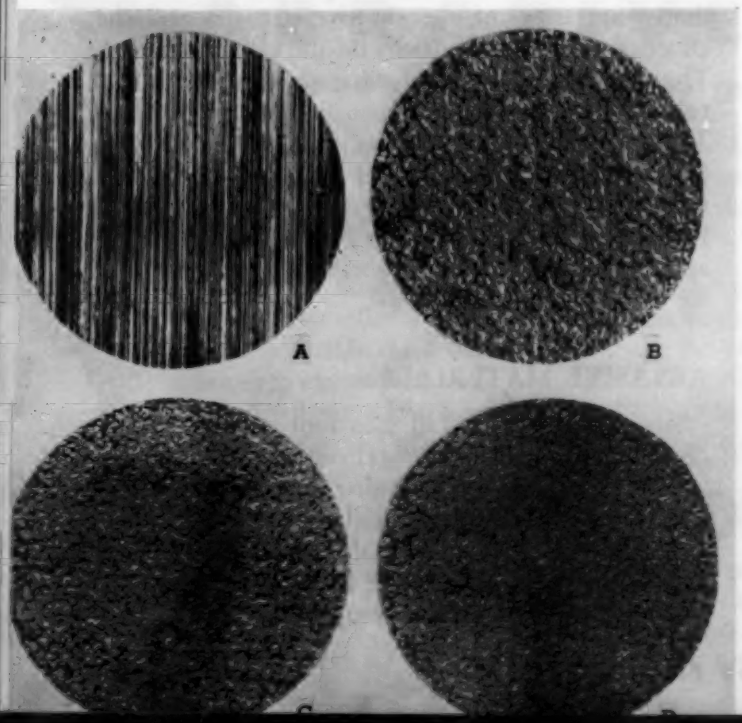
of that group with the others following in order of decreasing hardness.

In general, these abrasives have the following hardnesses:

Metallic	
Chilled Cast Iron	62 Rockwell C
Cast Steel	47 Rockwell C
Malleabrasive	37 Rockwell C
Artificial	
Silicon Carbide	9.6. Moh's Scale
Aluminum Oxide	9.2 Moh's Scale
Natural	
Garnet	8.0 Moh's Scale
Quartz	7.0 Moh's Scale
Silica	7.0 Moh's Scale

The hard abrasives cut deeper and faster than the others. For this reason chilled cast iron, malleable cast iron, and the natural abrasives are used for removing scale and burnt-in sand, and for knocking out cores from iron and steel castings.

In spite of the faster cleaning action of the hardest particles, only those soft enough not to embed in the metal should be used. If the abrasive particles lodge in the work, they can possibly damage machine tools, and in the case of aluminum or brass will corrode the casting.



ONE RESULT POSSIBLE FROM BLASTING is the elimination of grinding marks using different abrasives of varying fineness. Photo-micrographs here (67 diameters magnification) show comparison of (A) No. 4 grind (18-20 micro-inch AA) with (B) same surface after Hydro-Finishing with No. 100 Pangbornite abrasive, and (C) after Hydro-finishing with No. 325 Pangbornite abrasive, and (D) after Hydro-Finishing with No. 1250 Pangbornite.

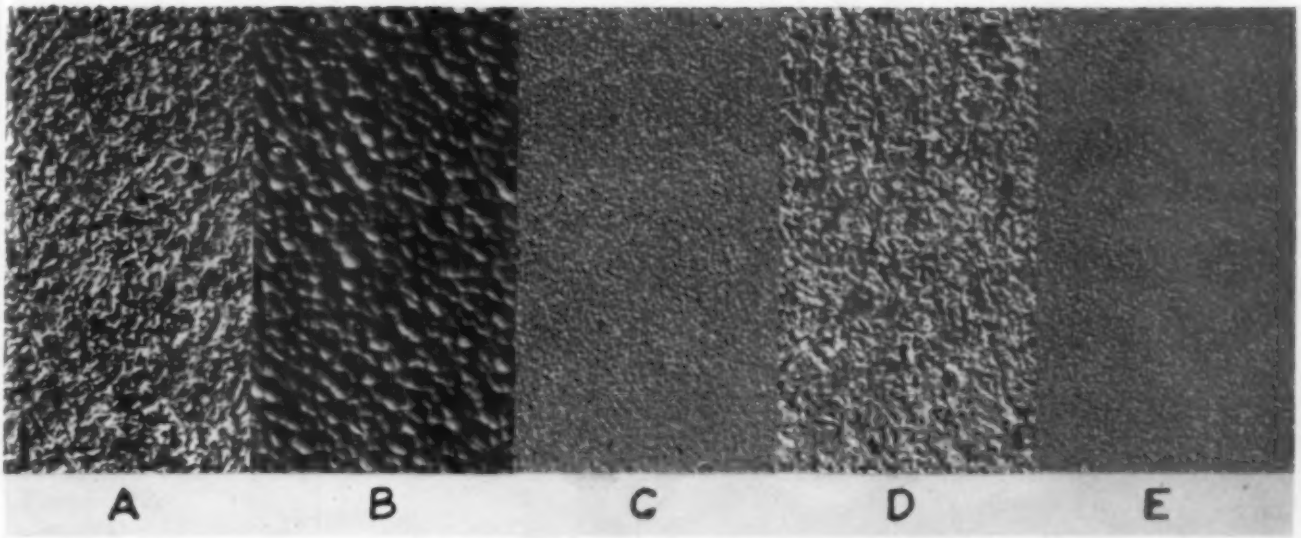
Abrasives softer than the metal they clean can remove material without substantially changing the dimensions of the metal. Even though nozzles are made of hard manganese alloy and boron carbide (said to be the hardest material known except diamond), prolonged flow of abrasive will wear them down. Softer abrasives wear nozzles less than do the others.

Agricultural abrasives serve particularly well in cleaning grease, oil, carbon, and similar material from finished parts and assembled equipment. Because the abrasives are often residues, they are much less expensive than petroleum-base solvents. The absorbing ability of the particles gives an effect similar to wiping. The most frequently-used abrasives are ground corncobs, small cubic hard-wood particles, and nut shell aggregates. Various degrees of abrasive action can be obtained by mixing a soft agricultural grit with a harder one, usually rice hulls.

The type of blasting equipment on hand influences the choice of abrasives. Four types of blasting are commonly used and can be designated by their propellant force, they are: (1) compressed air, (2) centrifugal, (3) high pressure water, and (4) a combination of compressed air and water.

Compressed Air:

(1) Uses any type of abrasive
(2) Blast pattern under close control



MAGNIFIED EXAMPLES of surfaces produced on aluminum and steel by blasting with various media. At A, a 5X magnification of the effect of 18 grit blast on aluminum. Compare this with the 5X magnification of the peening effect of No. 460 shot on aluminum sheet in view B. C shows the action of 200 grit abrasive on aluminum, 5X magnification. Views D and E show in 10X magnification the action of 25 and 200 grit abrasive, respectively, on steel sheet.

(3) By varying pressure or use of induction abrasive flow the blast intensity can be closely regulated. Equipment usually of simple construction and requires little maintenance.

(4) Possible to clean interior surfaces, chambers or holes, etc. The air stream removes the spent abrasive from the surface being impacted.

Centrifugal:

Most efficient with metallic abrasives. Requires less horsepower per pound of abrasive thrown.

High Pressure Water:

Uses sand abrasive. Removes sand cores and cleans surfaces at one operation. Dustless.

Compressed Air and Water:

Uses sand or natural abrasives of very fine grain size and produces smooth satin surface finish. Blast pattern under close control. Dustless.

SCREEN APERTURE AND STANDARD SCREEN NUMBERS

Screen Aperture In Inches	*Screen Number For Grit*	*Screen Number For Shot*
0.132		S-1320
0.0787	G-10	S-780
0.0394	G-18	
0.0331		S-330
0.0165	G-40	S-170
0.0070	G-80	S-70
0.0049	G-120	
0.0017	G-325	

Hydraulic equipment—which cleans by spraying the surface with abrasives suspended in water—uses aluminum oxide, quartz, silicon carbide, silica, and very fine-mesh natural abrasives (up to 5000 mesh). Agricultural abrasives in most instances require compressed-air blasters because individual particles are quite light. Air blasting uses chilled cast iron or sand for difficult jobs and malleable abrasive for lighter cleaning.

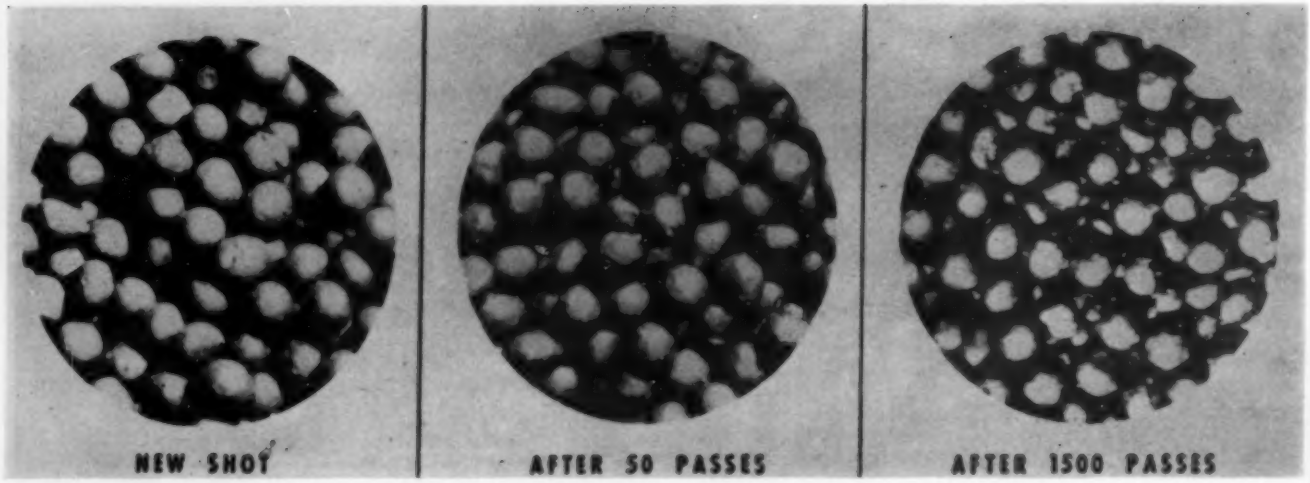
PARTICLE SHAPE AND SIZE

Most metallic abrasive particles can be classified as shot or grit. Shot is as nearly spherical as economy in manufacturing will allow. Grit is irregular and has many cutting edges. A few abrasives such as cylindrical cut wire and cubic hardwood particles do not fall into this classification.

Shot abrasive gives a peening effect. It hammers the metal, cracking and lifting the material to be removed. Grit both hammers and cuts the surface it is cleaning. Because of these differences in cleaning action, grit and shot are used for different applications. Basically, shot is used to remove foundry sand while grit is used for removing paint and rust and for preparing surfaces for further finishing.

When deciding on the abrasive size, consider the shapes of the metals to be cleaned. Because large shot ricochets when it strikes a surface, it is particularly good for cleaning intricate pieces. Large shot will bounce to hard-to-reach surfaces and will therefore do multiple cleaning before spending its energy.

Section thicknesses of the part being cleaned limit



WHAT HAPPENS TO STEEL SHOT No. 230 after 50 and 150 passes is graphically shown above. Steel shot doesn't break up into sharp pieces, but the reduction in size and the burnishing action which takes place may affect the nature of the surface obtained. Cast steel shot falls midway in the metallic media.

the size of the abrasive that should be used. Because larger particles are usually heavier, they develop greater kinetic energy, strike the surface with greater force, and peen the metal more vigorously. Heavy peening is very desirable in many cases. However, if the sections are thin the surface exposed to the barrage could possibly stretch enough to warp the sections.

The size of abrasive particles govern the coverage provided by the bombarding stream. Smaller particles give more uniform coverage with more overlapping and less chance to miss part of the surface in a once-over-lightly blasting.

Particle dimensions also affect the surface finish provided by blast cleaning. Small particles give fine finished; large particles produce coarser finishes. Shot gives a smooth, minutely dented surface; grit gives a rough surface covered with very small irregular cuts.

Because of the irregular shape of grits it is difficult to specify their size. The A.S.T.M. has devised a system for measuring the size of both grits and shot, based on passing a sample of the abrasive through a series of screens with diminishing mesh sizes. Three screen sizes—the high screen limit, the low screen limit, and the nominal screen—indicate the size of the particles.

The high screen limit is the size of the smallest screen which is too large to retain any of the sample. The low screen limit is the size of the largest screen which is too small to pass more than a given percentage of the sample. Percentages range from 5 to 25 per cent for shot and 10 to 35 per cent for grits. The nominal screen is the largest one which will retain a large percentage of the sample—85 to 65 per cent for shot and 80 to 20 per cent for grits.

Abrasive size is usually referred to by the aperture size of the nominal screen. The aperture is the distance between consecutive screen wires. Screen numbers have been assigned arbitrarily to aperture sizes to simplify the nomenclature. The screen number is used in specifying grits. For instance, G-18 means grits of nominal screen size number 18 or, referring to Table 2, an aperture of 0.0394 in. Similarly, S-330 means shot whose sample has a nominal screen aperture of 0.331 in.

RECOMMENDED ABRASIVE SIZES FOR REMOVAL OF SAND AND SCALE FROM FERROUS CASTINGS

Type of Abrasive	*Cast Iron*	*Malleable Iron*	*Steel*
Shot	S-550 to S-230	S-550 to S-330	S-660 to S-390
Grit	G-16 to G-40	G-18 to G-40	G-14 to G-25

IMPORTANT USES

More than half of the abrasives consumed each year are used to clean foundry sand and scale from

MOST COMMONLY USED ABRASIVES*

Metallic Abrasives	*Artificial Abrasives*	*Natural Abrasives*	*Agricultural Abrasives*
Chilled Cast Iron	Silicon Carbide	Garnet	Cocoanut Shells
Cast Steel	Aluminum Oxide	Quartz	Blast Walnut Shells
Malleable Cast Iron	Glass Beads	Silica	Pecan Shells
Crushed Steel	Refractory Slag	Decomposed Rock	Peach Pit Shells
Cut Steel Wire	Rock Wool Byproducts	(Novacite)	Filbert Shells
Aluminum			Cherry Pit Shells
Brass Shot			Almond Shells
Copper Shot			Apricot Pit Shells
			Rice Hulls
			Ground Corncobs

*Each group listed in order of decreasing hardness

ferrous castings. Table 3 gives the abrasives most commonly used in this application. Differences in choice represented in the table arise from differences in shape of the part to be cleaned, surface finish desired, and type of blasting equipment being used, as discussed previously.

The most effective abrasive that will not cause warping should be used to clean steel sheets and plates. Table 4 gives the abrasive size recommended for various plate thicknesses. Armor plate, which is hard, heavy and usually covered with thick scale, requires G-14 to G-25 abrasive. Some additional examples of grit selection for various jobs follow:

Weld splatter removal from castings requires hard metal grits to dig under the tenacious splatter. Fine finishes and uniform coverage of the work are usually desired. Use sizes G-25 to G-40.

Removal of rust and other corrosives covers many degrees of tenacity of deposit. Metal or sand abrasives are usually used. But, for the less tenacious corrosives, corncobs, wood particles and other agricultural grits are sufficiently abrasive. The proper size to use ranges from G-18 to G-50.

Paint removal is usually more satisfactory if the finish after cleaning is smooth, so less paint will be used in repainting. Use G-40 to G-50 abrasive.

RECOMMENDED ABRASIVE SIZES FOR SCALE REMOVAL FROM STEEL SHEETS AND PLATES

Steel Thickness	*Abrasive Size*
0.25–0.1093	G-40 to G-50
0.1093–0.05	G-80 and finer
0.05 and finer	Liquid media

Surface cleaning for applied finishes is generally governed by the thickness of the finish to be applied. Thick finishes call for more coarse cleaning to provide tooth for the coating. Grit sizes G-18 to G-40, depending on the type of finish, satisfy most requirements. Free carbon left on surfaces for sanitary enamel can cause the enameled surfaces to blister, bubble, or lift. Free carbon can be removed before enameling by passing the work over fuming nitric acid or using a small percentage of foundry sand mixed with the abrasive. A good way to combat the free carbon problem is to use a special malleable abrasive which contains carbon only in combined form.

NON-FERROUS CASTINGS

When cleaning non-ferrous castings, care must be taken not to embed the abrasive in the metal. For brass, bronze and magnesium castings, G-50 malleableized abrasive is recommended because of its softness and burnishing action. If shot is used, S-170 is recommended and malleableized shot is preferred.

Many blast cleaning jobs are special applications that can only be solved by experiment and by study of the particular problem. Examples of this are:

Aluminum rolls for drying cellophane are cleaned by S-230 to S-400 cast steel shot—to roughen the surface and provide traction for the film web passing over them in the drying process.

Cleaning railway car wheels and axles in preparation for "magna-fluxing" to test for cracks uses G-80 chilled cast iron grits.

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Grinding Universal joint flange on the Van Norman "Bowgage" 4BG2 .022 stock removal — 1.625 diam. — 15 R.M.S. — Maximum 480 pieces per hour.

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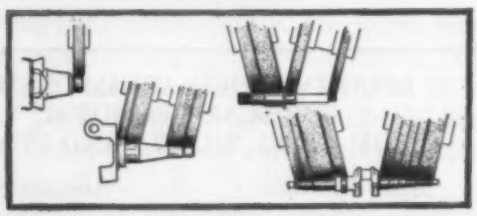
Sketches illustrate actual grinding applications performed for users of single and double head plunge cut special purpose grinding machines.



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***Manufacturers of* — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.**

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1. OPERATOR LOADS PART on pin-cam mandrel, one of three recently developed work driving devices described in this article. Mandrel finds most extensive application in operations on internally-splined gear blanks like one shown. Action of cammed surface of mandrel forces pins into line contact with flanks of spline, locking part.

Three recent developments in

Work Holders and Drivers

for precision grinding

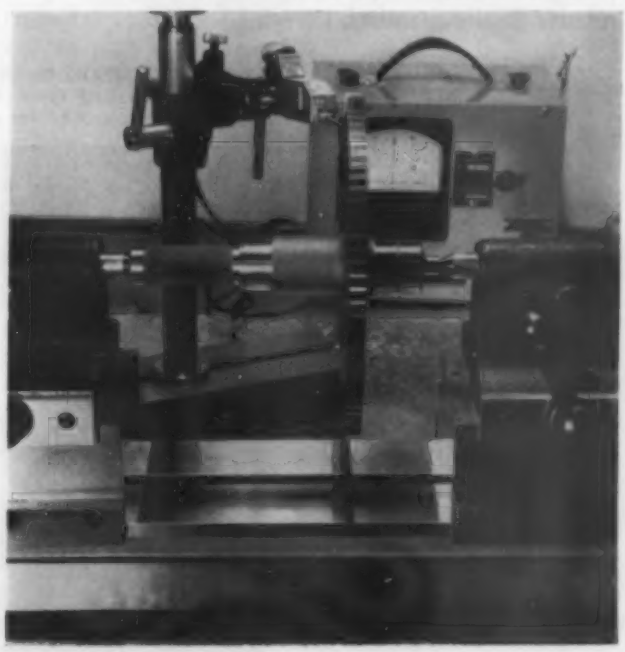
by **Harry Conn**
Chief Engineer
Scully-Jones and Company

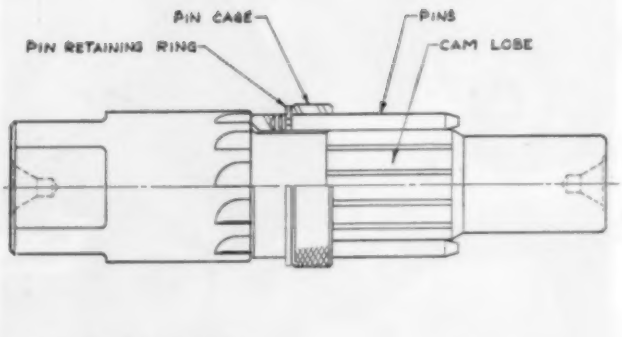
With the present-day need for greater precision in automobiles, farm equipment, aircraft engines, and other industrial products, one of the greatest single factors is the need for better concentricity in components. This need for concentricity is followed closely by the factor of squareness, together with the outside or inside tolerances.

In thinking about this precision, it will help if we consider the basic machine tool as the prime mover—the source of power, alignment and vibration-free accuracy. What is needed on grinding and other machines is real thought on the "hands and arms" of the machine that enable it to do an accurate job—the grinding wheel, the centers, the method of holding and checking the work, and in many cases the size control devices which provide dimensional accuracy.

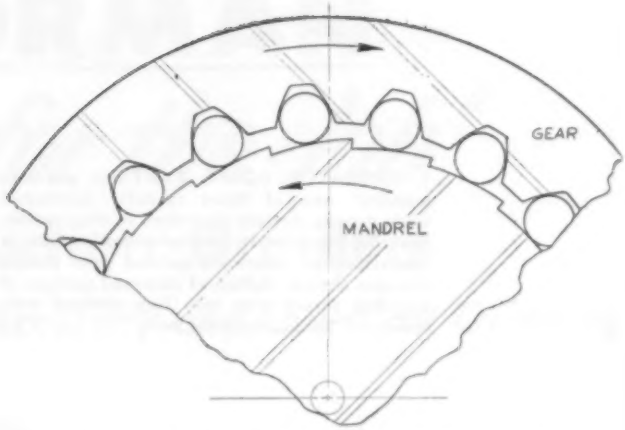
Before a part can be ground to a very close tolerance, it must be held to a very close tolerance. Before an OD can be ground concentric with the ID of a piece, if you're holding it on the ID, the ID must run concentric. There have been some recent developments in work holders and drivers which

2. PIN-CAM MANDREL is also used in checking and inspecting parts. Here a special test mandrel checks face squareness of aircraft engine gear at Jacobs engine plant. Pins of this mandrel give accurate reference with pitch line of shaft spline, so are more useful than conventional expanding mandrels which grip part on minor diameter.





3. PIN-CAM MANDREL.



4. ACTION OF RAMP-TYPE CAMS in pin-cam mandrel.

are of interest to people doing this type of work, notably in gear grinding.

Pin-Cam Mandrel

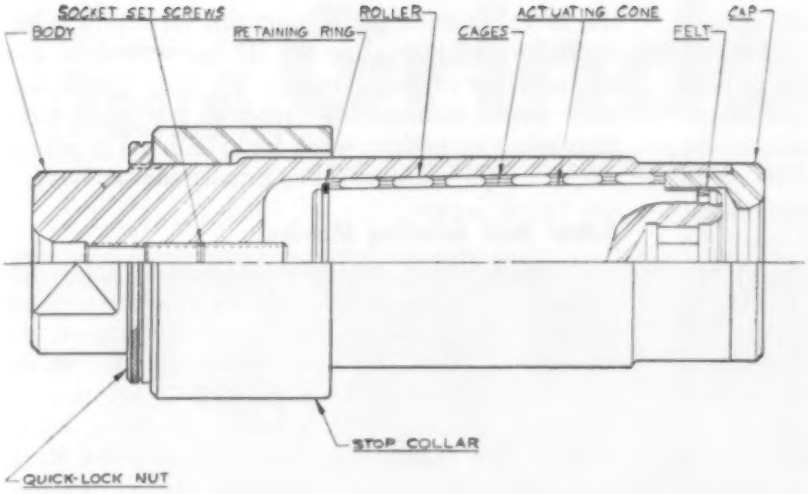
The higher the speed of gears, the higher the precision needs to be. It has been a real project of recent years to develop means of holding gear blanks so that the pitch line of the shaft splines run concentric with the pitch line of the teeth. When you have gears running at actual surface speeds of two and three miles a minute, as many present-day gears do any lack of concentricity causes them to set up a terrific howl or noise.

We have what is called a Pin-Cam mandrel, which is a solid mandrel designed to hold gears very accurately relative to the pitch line of their splined bore. The mandrel has ramp-type cams ground on it, and a series of rollers is positioned to ride axially across the cams as shown in Figure 3. Figure 4 shows the rollers on the cam, and the spline on the workpiece, and shows that as you turn the piece part relative to the mandrel, the pins are forced outward into line contact with adjacent splines on or near the pitch line.

The ramp-type cam is made with a low angle which becomes a locking angle to secure the workpiece. If the angle were too steep, it wouldn't lock, but if it were too gradual, it would be very difficult to loosen. A pin cage retains the rollers with a snap ring so they won't be lost. The thrust from the machining operation—turning, facing, grinding or hobbing—keeps the piece from loosening.

This particular mandrel has many advantages and is very simple in operation. You don't have to use an arbor press to load the piece on, so you don't have to worry about springing the mandrel under an arbor press. Furthermore, you can see from Figure 3 that the piece part can be located accurately in a lateral direction, and in the same place each time, by pulling it down against the stop collar. The pins apply equal force all around the splined bore, eliminating play and accurately locating the workpiece. Often the OD will be concentric with the splines within .0001-in. This is most important in hobbing, shaving or grinding operations on the teeth, as well

5. OPERATOR LOADS BLANK on pin-cam mandrel preparatory to grinding OD and faces, below left. Figure 6, below right, shows OD being ground for concentricity with splines.



7. ROLL-LOCK MANDREL is an expanding mandrel which operates on the elasticity of metal principle, through the spiral "threading" action of many rollers actuated by rotation of the tool's inner cone relative to the outer expanding shell.

as on the preliminary grinding operations on the OD and faces which prepare the blank for the tooth-forming operations. It is also important in the inspection of the gear following machining that the concentricity be held very closely.

The pin-cam mandrel is advantageous in that it can take up for a large tolerance in the spline, which can't usually be done using expanding mandrels which work on the elasticity of metals principle. We have expanded these mandrels as much as .030-in. to take up tolerances of that order. More important, we are locating on the flanks of the spline, very near the pitch line not on the minor diameter.

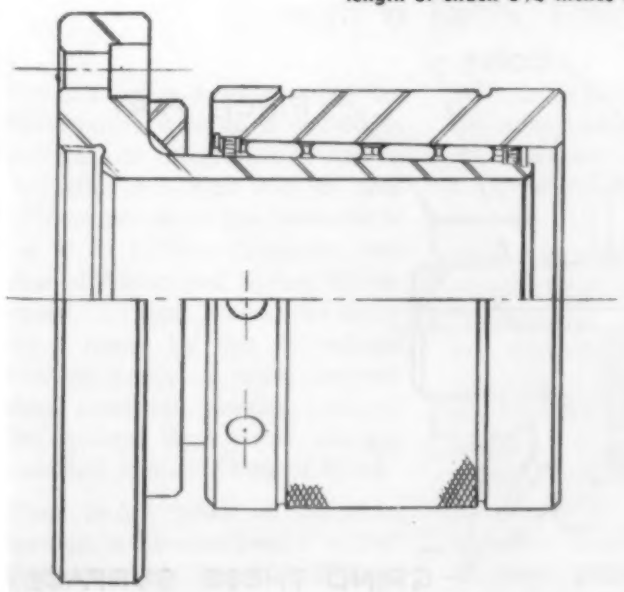
Figure 6 shows the grinding of a gear blank OD concentric with the spline, and the faces square with the spline within very close limits, preparing precise gears for hobbing. In the case of helical gears, any inaccuracies here would produce a wobble.

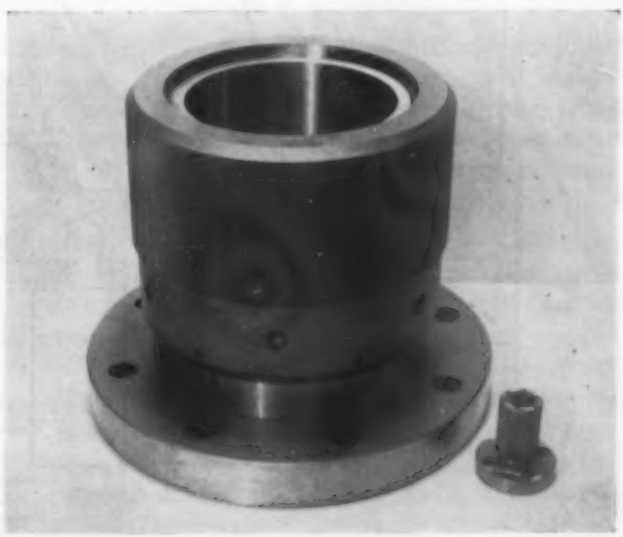
Roll-Lock Mandrel and Chuck

The Roll-Lock mandrel is an expanding mandrel which works on the principle of the elasticity of metal. It has an internal taper in the body, and has an operating cone with a corresponding taper on its OD. The OD of the outer body is expanded by the action of many rollers spaced on the periphery of the cone and held by a cage. The cage keeps the rollers skewed at a one degree angle, which causes them to climb up the cone as the cone is rotated relative to the body, and produces a wedging action. See Figure 7. The same lateral positioning feature is provided in this device as we have in the pin-cam mandrel, so that in a cylindrical grinder, for example, the operator can keep his stops set throughout a run of parts.

To operate the Roll-Lock, the operator merely slips

8. BELOW LEFT, IS A CROSS SECTION of the Roll-Lock chuck, a variation on the same principle used in the mandrel, which is used often in internal grinding. Figure 9, below right, shows range of sizes of these chucks which have been built for various applications. Large chuck shown is used for internal grinding job on jet aircraft rotor assembly. Piece part OD is 5.1189 /5.1182, chucking length approximately 4¼ inches, overall length of chuck 8¼ inches in open position.





the part to be ground on the mandrel up against the collar, and the inner cone is rotated to expand the mandrel OD. Stops built into the device prevent deformation of the outer shell beyond the elastic limit. About .002-in. of expansion is available for every inch in mandrel diameter, in mandrels up to 2 inches. For sizes above this, the amount of expansion is slightly less. Usually it is set to twice the permissible tolerance in the part being held. About one-half of the expansion is taken up in meeting the surface of the piece being chucked, and the balance is used in creating a shrink fit which allows transmission of the maximum given torque and thrust.

A Roll-Lock chuck identical in basic principle to the mandrel just described is available for external chucking of a part. In this case, the outer member is made thicker and stiffer than the inner member, which in the chuck is contracted to shrink the ID onto the part to be held.

One of the principal advantages of the Roll-Lock chuck and mandrel appears in grinding surfaces of hardened parts on which very slight depths of carbonization are specified. Many aircraft gears, for example, have a specified depth of carburization held within close limits, often within .005-in. To make sure that you don't destroy the specified hardness depth, you've got to hold the part concentric at least to closer tolerances than the hardness depth.

The Roll-Lock mandrel avoids the problems created by the use of tapered mandrels, on which the lateral position of the part can vary quite a bit, depending on how close the ID has been held and on the taper of the mandrel. We have found that their torque transmitting capacities are much more than adequate to drive work for cylindrical grinding, where torque transmitted is usually low anyway.

Better Hold Grinding Mandrel

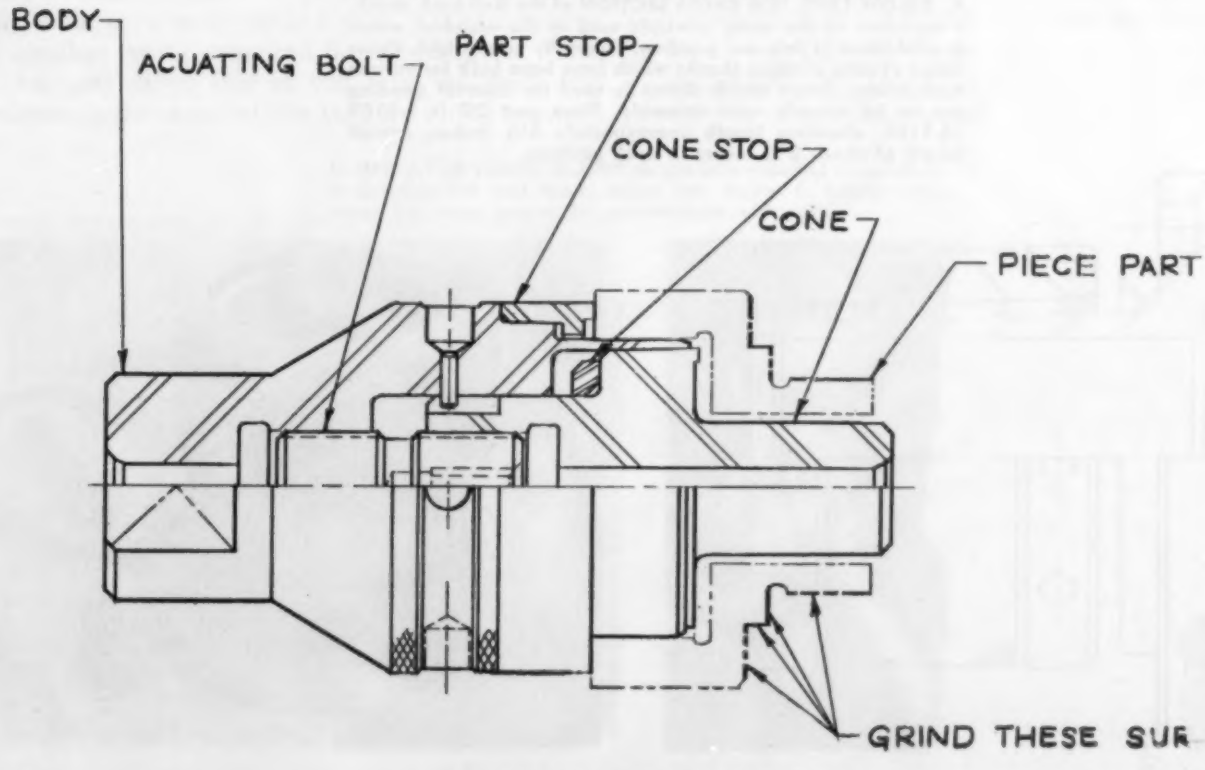
In this mandrel, which is designed to hold parts difficult or impossible to hold by any conventional method, we again have a device working on the elasticity of metal principle. We simply take up the tolerance in the hole by expanding solid metal, as shown in Figure 10. We harden the body, which includes the expanding outer shell, to 63-64 Rockwell C, because we can expand the stronger hardened metal better.

Here the interior cone is simply pulled into the tapered bore of the body by means of an Allen-head actuating bolt, which has standard right-hand threads on the portion which engages the body of the mandrel and left hand threads to engage the inner cone.

Again the part is located accurately in a lateral position, as well as having good concentricity. In the piece part shown in Figure 10, we are grinding two shoulders square with the ID, and two OD's concentric with the ID.

The total expansion available in the Better Hold device is actually a little better than we can get using the Roll-Lock type of mandrel or chuck.

10. BETTER HOLD GRINDING MANDREL is actuated by inner cone which expands outer shell of body as it is pulled into the body by the actuating bolt. OD and facing job is typical.



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BESLY **Grinderscope**

NEWS AND VIEWS ABOUT WAYS TO CUT COSTS WITH MACHINES AND METHODS

FROM BESLY-WELLES CORPORATION, SO. BELOIT, ILLINOIS

2½" long tractor valve springs made of .187 wire are fed to hopper from chute and easily placed in holders on the feedwheel of the Besly No. 918-30 Tandem Special Grinder. Alterations in feedwheel design can be made to accommodate different workpieces.

Grinding 100% More Springs Per Hour at ⅓ Less Cost

with a Besly Tandem Special Grinder

Manufacturing springs, from the finest music wire up to ⅝" diameter wire in all grades of carbon and alloy steels as well as nonferrous metals, is the business of the W. D. Gibson Company Division of Associated Spring Corporation, Chicago. Among the many types made by this 90-year-old leading producer are—compression, extension, torsion and all flat springs. Wire forms, too, are included in their "bag of tricks".

Since many types of industrial springs, in the sizes from 1" to 2½" diameter and from 1" to 3" long, have to be ground flat on the ends for more precise performance, the W. D. Gibson Company prefers to supply their springs ground, ready for use.

After years of testing, first with single disc grinders and then with "improvised", but highly ingenious, harnessed and paired single grinders, the Gibson engineering department hit upon the idea of having a double, or tandem, machine developed by a leading manufacturer to do their heavy grinding chores. The Production Engineer posed the problem to the Besly-Welles Corporation, offering his research and experimental work as help and proof that such a machine was practical. Besly management and engineers accepted the challenge.

After much cooperative work between Besly and Gibson engineering staffs, the Besly 918-30 Tandem Special Grinder was produced as "the answer" to these spring grinding problems. It employs the use of two pairs of grinding discs, diametrically opposed, separately powered and driven. A feedwheel moves pieces to be ground be-

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, So. Beloit, Illinois.

.130" of 44-48 C-Rockwell steel is removed in one pass. Tolerances are checked without interrupting the grinding sequence.

Machine is installed so that feedwheel is at a convenient work height for ease in loading.

Grinding 100% More Springs Per Hour (continued)

tween each pair of discs in succession in one revolution. In other words, this machine roughs and finish grinds in one controlled operation. The first pair of heads carry roughing discs for removing metal. The second pair grind the desired finish and tolerance. How efficiently this Besly Grinder performs for the W. D. Gibson Company can be realized from these results.

Since installation, a year and a half ago, production on the spring grinding operation has doubled, costs were cut one-third and one operator now does the job with less fatigue whereas two were required before.

The springs being ground in the photographs are 2½" long, 1¼" diameter tractor valve springs made from .187 44-48 C-Rockwell steel. Former methods resulted in only 900 springs ground per hour with double the manpower. Now, the production rate is 1800 per hour with half the labor at lower cost. On smaller springs the new rates reach as high as 2800, vs. 1400 per hour previously. There has been a 100% increase in grinding production all along the line.

In the grinding cycle shown here, springs are fed into a hopper from an overhead chute. They are then placed into specially-designed flat holders, the holes and thickness of which vary in size according to diameter and length of the springs. As the feedwheel rotates, the first pair of 30" solid abrasive discs rough grind both ends of the springs at once, removing .100" of material. Further along, in the same rotation, a second pair of 30" solid abrasive discs finish grind to a tolerance of 45 lbs±

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2¼ lbs., removing .030" of material. A total of .130" of material is removed in one pass through the machine. Springs automatically unload into boxes through an opening at the end of one complete feedwheel revolution. Roller conveyors carry full boxes on to the next operation of shot peening.

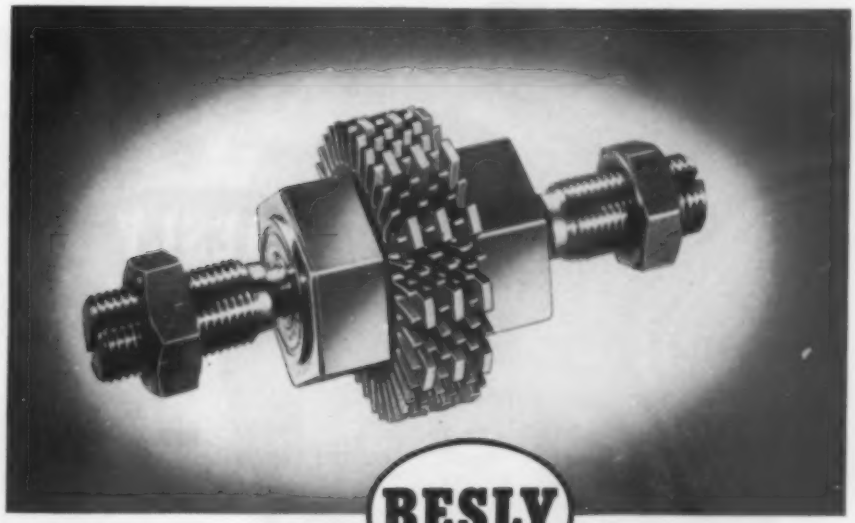
The unique design of the feedwheel used here was developed especially for spring grinding purposes. However, it can be altered to accommodate nearly any size of workpiece which can be more economically ground at higher production rates on this big Besly Tandem Special Grinder. The engineering staff of Besly will be glad to show you ways in which this can be done for your work.

A special feature of this Besly Grinder is the orbital grinding action produced by an eccentric type feedwheel (Pat. Applied For). A combined oscillating and rotating motion causes the work to travel in a wave-like pattern across the face of the discs. This process exposes many more abrasive cutting edges and produces more efficient grinding. Longer disc life and less frequent dressing result.

The W. D. Gibson Company finds that this Besly Grinder requires very little maintenance and gives them a lower unit production cost, a higher production rate and more uniform products. Benefits, which all result in sales advantages.

You, too, can benefit from Besly's many years of experience in the grinding field. Whatever your grinding problem, Besly engineers will be happy to help you solve it. A bulletin describing the complete line of Besly Grinders is available on request.

SEND COUPON ON BACK PAGE FOR FREE BULLETIN NO. 900



BESLY

New

TYPE A "WISE" (PATENTED)

DRESSER CUTTER ASSEMBLY

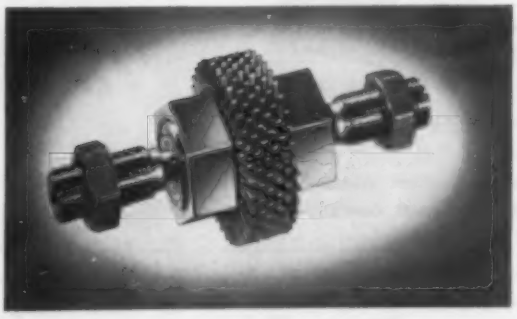
IDEAL for dressing Hard abrasive discs

- GIVES BEST RESULTS
- LASTS LONGER
- ECONOMICAL PERFORMANCE
- LOW UNIT COST
- ADVANCED DESIGN
- SQUARE ARBOR FOR LONGER SPINDLE LIFE
- INTERCHANGEABLE PARTS
- ADAPTABLE TO ALL GRINDERS USING 2½" DIAMETER CUTTERS

Notice the combination of fine and broad teeth used in this *new* Besly Type A "Wise" Dresser Cutter Assembly. It provides both the perfect dressing performance and longer service life required for hard abrasive disc dressing.

The fine teeth pick abrasive grain from the surface producing a cutting action that *sharpens* without changing grinding characteristics. The broad teeth prolong the life of the dresser cutters.

Square design of the "tru-square" arbor prevents keyway chewing and spindle damage. Sealed ball bearings provide frictionless rotation. Built-in buttons eliminate spacer washers and interlock complete assembly assuring accurate tooth spacing. Six cutter blades to the set come taped ready to assemble eliminating handling of individual cutters. Interchangeable with standard "Wise Type" Dresser Cutter Assembly.



STANDARD Besly "WISE TYPE" Patented DRESSER CUTTER ASSEMBLY is particularly suitable for softer disc dressing. All fine tooth wheels provide "pick-action" dressing performance at lower cost. Has all the fine features of and is interchangeable with the new Type A.

Ask for trial and prices, send coupon on back page.

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, So. Beloit, Illinois

grind 400% more pieces without dressing

Yes sir, that's the result obtained by a leading maker of small parts like those shown.

Previous discs used required dressing about every 5,000 pieces, or at 45 minute intervals. Besly-Titan Zone-Type Discs ground 23,000 pieces, or *for* 3 *hours* without dressing. 2,500,000 pieces are ground per set of 2" thick abrasive discs. By grinding 400% more pieces without dressing, you can readily see how this manufacturer saved important money in production costs!

This is but one more example of the superior quality and efficiency of Besly-Titan Resinoid Abrasive Discs. They are scientifically developed in any desired combination of zoned grading to exactly meet the requirements of each individual grinding job—just as they were done for this user!

Ask our Abrasive Engineer to show you how Besly-Titan zone-type or other discs can improve your grinding efficiency.

.008" of stock removal (.004" per side), holding to less than .0005" for parallelism is required in the production of these small parts.

NEW BOOKLET . . .
contains the facts about Abrasive Discs and Wheels. Get your free copy, *now!* Send coupon below.

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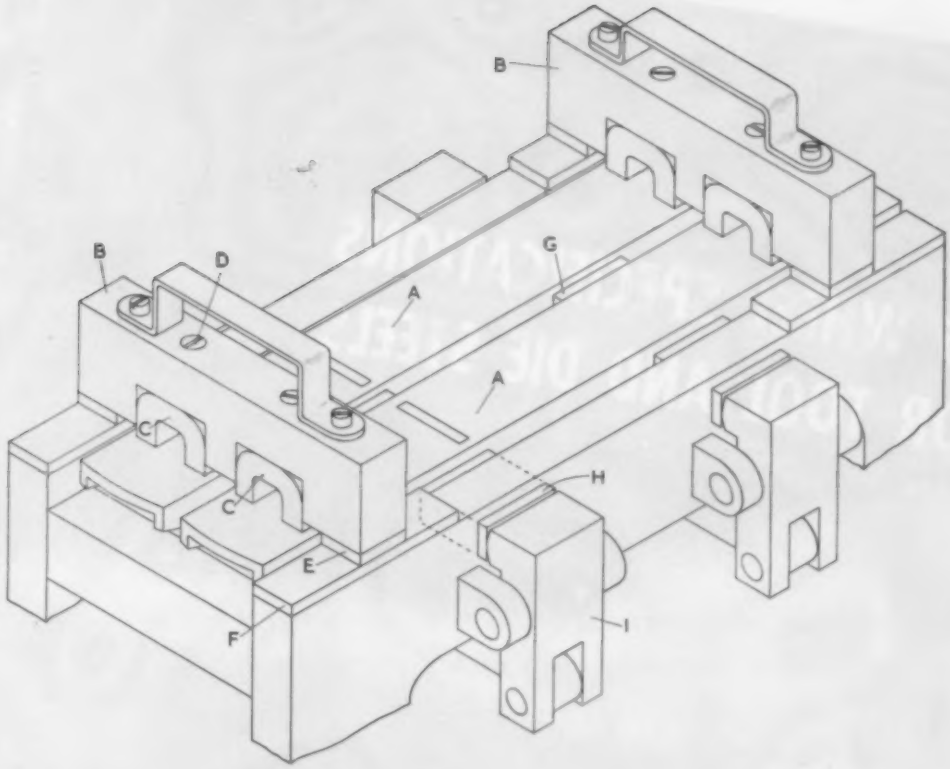


Magnetic Work Locators

. . . for a grinding operation

Modern permanent magnets have sufficient strength to locate and hold work pieces in place until they can be finally clamped in position. After clamping, the locators can be removed by the operator exerting a sharp pull.

By **C. T. Bower,** Tool Engineer, London, England

● One application of permanent magnet locators to a grinding operation is shown in the sketch. The components A are steel-bodied carpenters' planes which are ground on the lower surface, by one maker, to impart a smooth surface which will slip freely over the wood when in use.

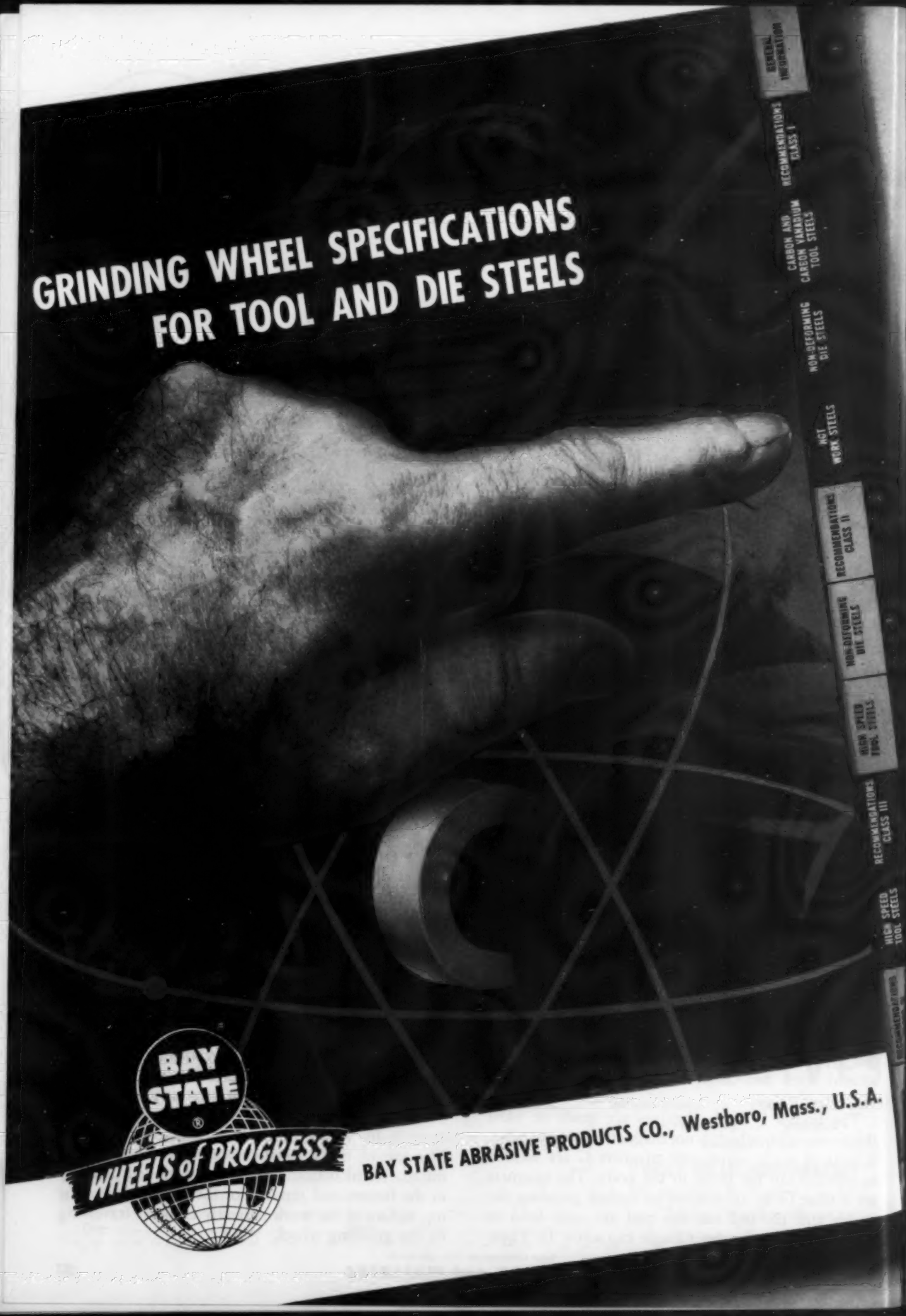
Before the grinding operation, the plane bodies are milled to size on the sides and the bottom face. For grinding, the bodies are placed in pairs in a box type fixture, as shown, and the top surface is located level and at correct height by a pair of magnetic bridges.

The bodies B of the bridges are made of hard aluminum alloy which is not magnetically permeable. A pair of stock permanent magnets C are located in notches cut for them in the body. The magnets are a close fit in the notches by surface grinding the width and the top surfaces and are each held in place in the notches by a single cap screw D. These magnets are drilled and tapped with one hole in the yoke connecting the pole pieces and this is used for accommodating the holding screw.

The soft metal bridge body is reinforced at the ends by hardened pads E which are screwed and dowelled in position on them. The lower surfaces of the pads rest on hardened pads F which are integral with the soft steel body of the fixture.

The fixture is of hollow box form standing on legs on the surface grinder table and is fitted with pneumatically actuated clamps, the air cylinders for which are housed in the lower part. Clamping of the components is horizontally, from the sides. There is a fixed work location G separating the two components and sliding clamp blocks H push the pieces into contact with these. Rocker arms I are pushed outward at their lower ends by the air cylinders and pivot so as to push the clamp blocks inward.

The shape of the average carpenters' plane is familiar in that it comprises a substantially channel shaped casting which is not machined internally. It is, therefore, a difficult component to locate accurately by working off the unmachined surfaces. The use of the magnetic locating bridges enables the machined bottom face to be positioned precisely in the fixture and removal of the bridges leaves the top surface of the work perfectly clear for traversing by the grinding wheel. • •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Available Literature

Catalogs and Bulletins Available from Manufacturers

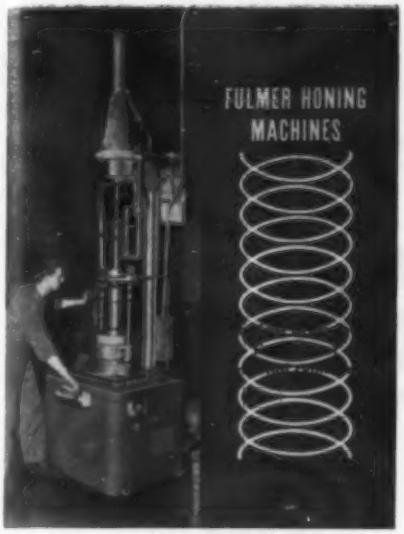
To receive your free copy of any of the literature listed here, use the handy post-paid postcard opposite page 72. Just circle the identifying number on the card and mail it. We'll take care of the rest.

1. Rotary Grinder. The new Thompson TR twin rotary grinders are described and illustrated in a new catalog available from the Thompson Grinder Co., Dept. GF, Springfield, O. Photographs of the circular grinding machines with description and location of controls and other features, together with complete specifications, are included. A horizontal wheel head grinds with a 14″ or 20″ diameter wheel to controlled size with automatic dressing and automatic compensation of the feed screw. Simultaneous loading and grinding reduces cycle time by 40%.

(see Number 1.)

2. Jig Grinding. Jig grinding at 65,000 rpm with the Vulcanaire is described in literature available from Vulcan Tool Co., Dept. GR, Dayton 10, O. You can insert the Vulcanaire into your jig borer spindle the same as you would a boring chuck, and your jig borer becomes a high speed precision grinder. It is then possible to accurately locate and finish grind hardened holes to tenths, with the required speeds for small grinding wheels (30,000 to 65,000 rpm). By the same method you can detach the Vulcanaire and your machine is again a jig borer.

(see Number 2.)



(see Number 3.)

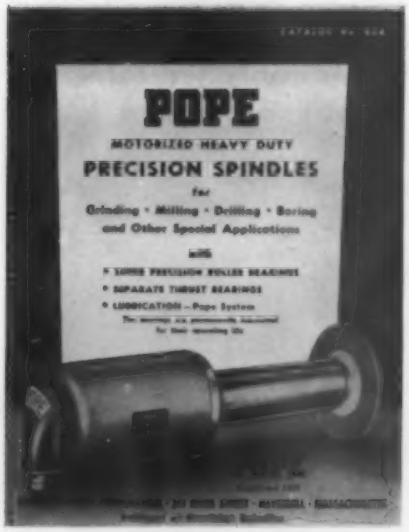
3. Honing Machines. Fast precision finishing of internal cylinders is described in literature available from C. Allen Fulmer Co., Dept. F, 1211 First National Bank Bldg., Cincinnati 2, O. Honing processes, applications and the Fulmer line of machines are described and illustrated along with complete specifications. Because of advancements made in honing machines and stones, it is no longer merely a polishing operation, but can successfully be used for stock removal.

4. Barrel Finishing. The Almco Div. of Queen Stove Works, Inc., Dept. GR, Albert Lea, Minn., has just published a new 52-page general catalog of Supersheen barrel finishing equipment. This catalog has been divided into four subjects which include: (1) An explanation of barrel finishing and the variables involved; (2) Almco sample processing laboratories; (3) The various types of Supersheen barrel finishing machines and accessory equipment; and (4) The types and uses of Supersheen medias and finishing compounds.

(see Number 4.)

5. Precision Spindles. Catalog No. 60A, available from Pope Machinery Corp., Dept. FF, 261 River St., Haverhill, Mass., describes and illustrates the complete line of motorized heavy duty precision spindles for grinding, milling, drilling, boring and other special applications. The Pope system of lubrication requires no further addition or attention for the operating life of the bearings.

6. Universal Grinding Machines. The complete line of Cincinnati Filmatic 12″, 14″ and 18″ universal grinding machines are described and illustrated in Catalog No. G-663, available from Cincinnati Grinders, Inc., Dept. RG, Cincinnati 9, O. These machines are especially suited to the precision grinding of a wide assortment of tool-



(see Number 5.)

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Combines the new Delpark powerful magnetic separator with a permanent filter media bar stock screen. Swarf bearing liquids flow on top of a large flat magnetic field. Magnetic unit incorporates more Alnico #5 magnets, gives twice the width of field, brings all swarf in suspension within the influence of the magnetic field, puts gravity to work in assisting the magnets and prevents washing and turbidity by using low velocity flow. This feature is particularly desirable on high viscosity fluids.

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room and variety production work including; straight cylindrical, taper, bevel, shoulder, chuck work, internal, face and rotary surface grinding.

(see Number 6.)

7. Electrolytic Grinding. Bulletin No. 300, available from Anocut Engineering Co., Dept. FG, 631 W. Washington Blvd., Chicago 6, Ill., outlines the procedures in adapting any standard grinder for use with the Anocut Process. Complete with cutaways, exploded views and parts recommendations, this bulletin contains much to interest anyone who is contemplating the use of electrolytic grinding.

8. Abrasive Belt Grinder. The Model 680 multiple-head, conveyor-type abrasive belt grinder is described and illustrated in literature published by The Engelberg Huller Co., Inc., Dept. GG, 831 W. Fayette St., Syracuse 4, N.Y. This semi-automatic machine gives precision finishing to close tolerances on flat surfaces of any ferrous, non-ferrous, plastic or other material. It is available with single head, double head, or any number of heads.

9. Gaging and Sorting. High speed automatic gaging and sorting of precision parts is described and illustrated in a new bulletin available from Federal Products Corp., Dept. G, 1144 Eddy St., Providence 1, R. I. Purpose of the bulletin is to point out the practical use and versatility of automatic gages of various types including multi-dimension, continuous measuring, machine control and automatic sorting gages.

10. Roll Grinders. Bulletin No. 115 describes and illustrates heavy duty roll grinders for precision production in heavy roughing or fine finishing. Bulletin is published by Farrel-Birmingham Co., Inc., Dept. GF, Ansonia, Conn. These machines are built in six standard sizes to take maximum diameters of 24", 28", 36", 44", 50" and 60", and in any length required.

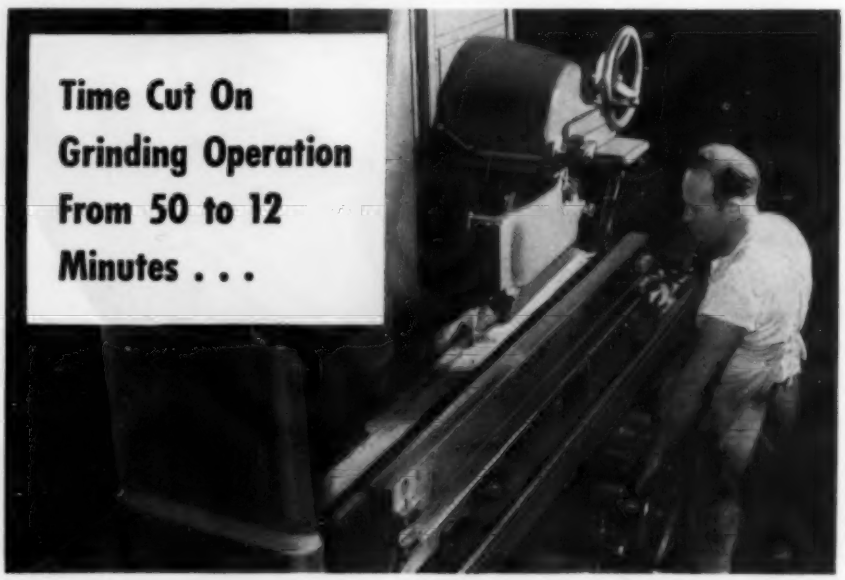
11. Portable Air Grinders. The Hask Air grinder featuring 75,000 rpm is described and illustrated in literature available from R. G. Haskins Co., Dept. GR, 2651 W. Harrison St., Chicago 12, Ill. This portable air turbine grinder features sustained power, and maintains its high-speed efficiency under load. It is available with a complete line of carbides, mounted points, cutters, files and other tools.

12. Optical Comparator. Model FC-30, 30" screen comparator is described in literature available from Jones & Lamson Machine Co., Dept. FG, Springfield, Vt. Precision ground lenses and mirrors are available from .062" to 6" aperture, and 5 to 125 magnifications (up to 250 mags. on special applications). One minute vernier and graduated chart ring allow the operator to take readings to the exact minute.

13. Diamond Tools. Koebel Diamond Tool Co., Dept. G, 9456 Grinnell, Detroit 13, Mich., has literature available describing and illustrating Kodi interchangeable diamond tools. One of these interchangeable diamond tools replaces many present type tools, reduces and simplifies inventory, and increases the utility of the available diamond supply.

14. Roll Grinders. Landis Type 30 roll grinders, available in 36", 44", 50" and 60" swings and center lengths from 10 feet to 24 feet are featured in a new catalog published by Landis Tool Co., Dept. GF, Waynesboro, Pa. This machine can grind rolls from 45 tons to 82½ tons depending on the machine size. Included is a complete description of the machine, specifications and standard and extra equipment.

15. Gages. A new catalog published by H. E. Morse Co., Dept. FG, Holland, Mich., features the complete Hemco



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There's a good chance that you may be able to save considerable time in milling or grinding operations with Sundstrand "Power-Grip" Magnetic Chucks. Call in a Sundstrand Engineer. There is no obligation for this service.

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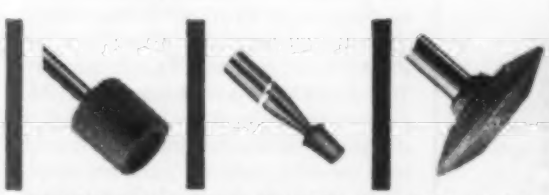

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GUARANTEED to stay on their mandrels, they are perfectly balanced, easily dressed, and hold their shape.

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Chicago Wheel and Mfg. Co.

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SEND ME SAMPLE CHICAGO MOUNTED WHEELS

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line of gages. Included are cylindrical plug gages; cylindrical ring gages; plug thread gages; ring thread gages; thread setting gages; truncated setting plug gages; pipe thread gages; master setting discs; special type gages; and thread measuring wires. Also included are tables, charts and decimal equivalent tables.

16. Gear Deburring. Bulletin 103-60, available from Modern Industrial Engineering Co., Dept. F, 14230 Birwood Ave., Detroit 38, Mich., features production gear burring and chamfering on the universal Burr-Master. This universal machine chamfers the entire tooth form of both spur and helical gears, as well as external straight and involute form splines. It is available in 8 models and provides an operating size range from ⅛ to 9½ inches pitch diameter.

17. Surface Roughness Measurement. Micrometrical Mfg. Co., Dept. GG, 345 S. Main St., Ann Arbor, Mich., has literature available introducing the new Profilometer Group 11 for measuring surface roughness. This versatile package includes Mototrace, Amplimeter and the new Type LJ Tracer and is said to measure more than 85% of all the varied surfaces produced by industry.

18. "Proprietary Manufacturing Know-How and National Defense Requirements" is the title of a new booklet available from the Machinery and Allied Products Institute, Dept. GF, 1200 18th St., Washington 6, D.C. No single problem in the field of government procurement is of greater current significance to defense contractors than the problem of acquisition by government contract of manufacturers' proprietary technical data or know-how. This subject, which has given rise to widespread misunderstanding and concern over governmental intentions, is the subject of this recent MAPI pamphlet.

19. Coolant Aerator. How to stop coolant splash through the use of the Mel-O-Flo coolant Aerator is the subject of literature available from Melard Mfg. Corp., Dept. FF, 432 Austin Pl., New York 55, N.Y. This aerator for soluble and light oils connects to the coolant line and mixes atmospheric air with coolant, resulting in a non-splash aerated mixture that clings to work and tools.

20. Barrel Finishing. A folder describing barrel finishing methods and materials has recently been published by Oakite Products, Inc., 157 Rector St., New York 6, N.Y. It is designed to give metal fabricators an over-all view of the problems and requirements inherent in this fast growing method of finishing metal. The subject is discussed from pre-cleaning to final rinse.

21. Centerless Belt Grinder. Type 486 centerless grinding and finishing machine, for precision work on light applications, is featured in literature available from Production Machine Co., Dept. GFR, Greenfield, Mass. This machine will handle bar stock up to 1" diameter, and tubing up to 3" diameter, any length, within the weight limitations of the machine. The feed unit may be equipped with reversing traverse device when multiple passes are required.

22. Wheel Forming Attachment. Models 4A and 4B Diaform wheel forming attachments are described in literature available from Pratt & Whitney Div. of Niles-Bement-Pond Co., Dept. GF, West Hartford 1, Conn. The 4A is designed for use on medium size and heavy duty, horizontal spindle surface grinders, which have clockwise spindle rotation. The 4B is primarily designed for use on grinders with counter-clockwise wheel rotation.

23. Brushes. "Typical Problems solved by Pittsburgh Brushes" is the title of a new booklet available from Pittsburgh Plate Glass Co., Dept. FG, Brush Div., 3221 Frederick Ave., Baltimore 29, Md. Reports in the book describe typical installations in which Pittsburgh brushes have solved a problem. Some are simple, some are more involved; but most of them are common to all industry.

24. Barrel Finishing. Literature available from Rampe Mfg. Co., Dept. F, Cleveland, O., describes and illustrates the V8 precision barrel finishing machine which has one to four compart-

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most powerful air turbine grinder in its class!

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(1/5 H.P. prony brake test)

- **Permanently sealed bearings . . . never needs lubrication in air lines or grinder.**
- **Removable nose piece for deep grinding.**
- **Gyro action of turbine holds tool steady.**

Here's power—SUSTAINED POWER—like you've never experienced before in an air grinder . . . power unexceeded by any other air grinder in the same price range . . . maintains its high-speed efficiency under load! Built with a lightweight, contoured, hand-fitting aluminum housing, the Haskins hask AIR Grinder handles easily, balances perfectly . . . excellent for the most precise grinding job. Complete kit includes: carrying case, adapter hose, mounted points, dressing stone and wrenches.

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ments. These compartments are individual barrels which are readily interchangeable. It has a 1½ hp magnetic brake motor with jogging and reverse switch for heaviest load. Its improved power drive features direct gears, with no chains or sprockets.

25. Grinding Centers. The Ready Tool Co., Dept. RG, 554 Iranistan Ave., Bridgeport, Conn., has a new illustrated folder available introducing the new Red-E grinding concept, claimed to overcome chatter, wheel marks, out-of-roundness and the costly secondary operations required for super finishing and lapping in cylindrical grinding. Folder lists grinding problems when work is turned on dead or solid centers.

26. Drill Grinder. Literature available from J. R. Reinertson & Co., Dept. G, 4744 W. Lake St., Chicago 44, Ill., describes the Sterling Model DV, variable angle drill grinder. This machine has a built-in diamond wheel dresser, and any included angle from 90° to 140° is easily obtainable. It will handle 2, 3, and 4 lip drills from ⅛" to 2½" diameter.

27. Form Relieving Fixture. How to get more cuts per grind for all your end cutting and side cutting tools is described in literature published by the Grinder Div. of the Royal Oak Tool & Machine Co., Dept. RG, 29800 Stephenson Hwy., Royal Oak, Mich. This new universal form relieving fixture is of entirely new design and operates on entirely different principles than any equipment formerly made by Royal Oak.

28. Screen Separator. Rampe Mfg. Co., Dept. FF, Cleveland, O., has literature available describing their new electric screen separating machine which is either portable, or can be used in a permanently fixed position. Screens can be quickly changed, and it uses either standard 24" foundry riddles, or square screen 24" x 24". Hopper under screen directs material into tote pan underneath. Materials can be washed directly on screens.

29. Carbide Grinding Wheels. A new bulletin describing and illustrating abrasives for grinding carbide tools is available from Robertson Mfg. Co., Dept. 49, P.O. Box 848, Trenton 5, N.J. Bulletin contains information on standard wheel types and sizes for various operations. It also furnishes wheel sizes, plate specifications and Robertson blue print numbers of 23 plate mounted vitrified wheels for 30 grinding machines made by 16 different manufacturers.

30. Snagging Grinders. Bulletin C1, available from The Standard Electrical Tool Co., Dept. RFG, 2488-96 River Rd., Cincinnati 4, O., describes their complete line of infinitely variable speed snagging grinders. The advanced design features of these machines are thoroughly discussed along with complete specification tables.

31. Honing Machine. Literature available from Sunnen Products Co., Dept. F, 7910 Manchester Ave., St. Louis 17, Mo., describes and illustrates the MBB-1290-D precision honing machine for production, tool room, salvage and maintenance. This universal machine will size holes to any tolerance and surface finish specified. It has a fast production rate and is low in initial and operating costs.

32. Lapping Machine. Bulletin 755-BG, available from Spitfire Tool Co., Dept. GF, 2931 N. Pulaski Rd., Chicago 41, Ill., describes and illustrates the Gyro-Matic 21 lapping machine for automatic super-fine finishing. Machine features simple operation; substantial savings of time and cost; versatile micro-inch lapping on a volume basis; and optical flatness to 1 light band (.0000116).

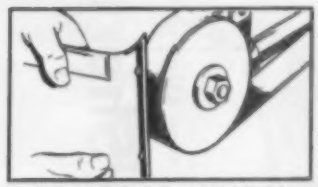
33. Quenching Oil. A new fast quenching oil, Sunquench 78, is the subject of technical bulletin 45, available from Sun Oil Co., Dept. RFG, Philadelphia 3, Pa. Bulletin explains the mechanism of quenching, and tells how Sunquench 78 gives deeper and greater hardening of low-alloy steels and reduced distortion of irregularly shaped parts.

34. Portable Tools. Skil Corp., Dept. GG, 5033 Elston Ave., Chicago 30, Ill., has a new catalog available featuring their complete line of portable tools for the manufacturing, construction and automotive industries. The complete line of portable and bench grinders, sanders, brushes and polishers are included with illustrations of all available models.

Hammond of KALAMAZOO

FOR DEBURRING ECONOMY

Model 50-DD



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IRREGULAR SHAPES

FLAT WORK

It is remarkable how soon these Abrasive Belt Machines pay for themselves in grinding, polishing and deburring.
11 combinations available with or without Duskolector.

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See Us At Booth No. 1250 Metal Show, Cleveland—Oct. 8-12
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Shop Hints and Short Cuts

Grinding Thin Non-Ferrous Sheet Stock

By **H. J. Gerber**

We often have need for small quantities of brass or aluminum strip material in precision thicknesses of non-standard gages. The obvious machining method seems to be surface grinding but we found it difficult to secure the material to the surface of the magnetic chuck. We tried holding the stock in a matrix of sealing wax and also by the commonly recommended method of securing with double coated pressure sensitive tape. Neither of these two methods held the material perfectly flat.

We now use a method much simpler than either of the two above mentioned. Two pieces of sheared sheet stock are laid on the carefully cleaned magnetic chuck with a considerable gap between them. A large piece of flat CRS is now placed on top of the two non-ferrous strips. Enough of one strip is left exposed for grinding the desired width of material. The magnetic chuck is now energized and will usually provide enough pull on the C.R.S. flat to hold the work tightly in place for grinding. The exposed strip is then ground to desired thickness and sheared off the wider stock strip.

This method is simple and will work very well on material up to 3/32" in thickness. I have been unable to hold ⅛" sheet in this manner on the magnetic chucks in our shop but these thicker gages can usually be bedded down flat by pouring hot sealing wax around the edge of the strip. • •

Holding thin aluminum sheet stock on magnetic chuck. Flat steel bar laid on top of two separated chips. Protruding edge of one strip is then ground to thickness.

Douglas Aircraft Reports Large Savings by Salvaging Diamond Chips from Grinders

Small, shallow pans placed under diamond grinding wheels at the Torrance facility of the Douglas Aircraft company's El Segundo Division are salvaging over $1200 worth of industrial diamond chips a month. Similar savings can be made wherever diamond wheels are used to sharpen carbide tools.

The investment in the small pans totaled less than $40.00 for 14 grinders and the system salvaged 738 carats of industrial diamonds in the first 30 day period. • •

FAST! ACCURATE!

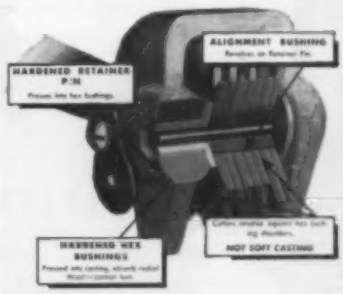
GRINDING WHEEL DRESSINGS with VINCENT DRESSERS and CUTTERS

Vincent Dressers and Cutters are precision tools for shaping, trueing, dressing and removing the glaze on all grinding wheels. Their efficiency is a direct result of design, selected materials and know-how in manufacturing.

DESIGN—The Vincent design eliminates wear and assures correct alignment. Hardened hex bushings cannot turn—absorb side and radial thrust during operation.

MATERIALS—All moving parts are made of specially selected steel, uniformly heat treated and tempered to the exact degree of hardness and toughness required for maximum life.

MANUFACTURE—Exacting control of heat treatment by means of the exclusive "Vincent Process" produces cutter teeth which will not mush over or break off.



Ask your industrial distributor for information on Vincent Dressers and Cutters. He will show you how proper dressing will increase the life of your grinding wheels and improve their operation.

VINCENT STEEL PROCESS COMPANY

Producers of: GRINDING WHEEL DRESSERS AND CUTTERS • HSS TOOL BITS • DIAMOND DRESSING TOOLS CONICAL CUTTERS AND HOLDERS • TUBE CLEANER CUTTERS • HIGHWAY SURFACE CUTTERS

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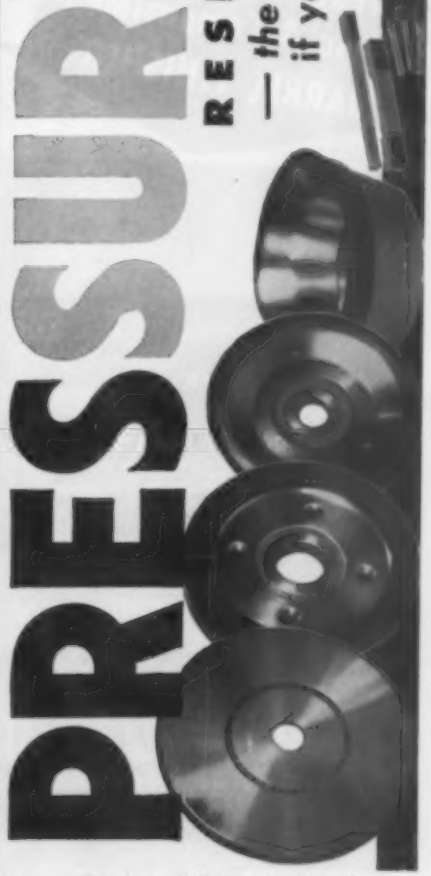
RESINOID DIAMOND WHEELS

— the best diamond wheel bond ever developed —
if you've used them - you know they're best!
if you haven't - let us show you!

UNITED STATES DIAMOND WHEEL CO. AURORA, ILL.



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Storing Palletized Wheels

A space saving system of storing palletized grinding wheels was developed by Larry Dauer (left) and Joe Lippert of Norton Company's Pittsburgh warehouse. Key to the system is the wooden saddle they are holding. Made of palletizing lumber, reinforced with a steel strap, this saddle makes it possible to stack pallets of grinding wheels three or four high. Former method of storage was by "pyramid" stacking. Nearly twice as many pallets can be stacked in the same area using the new system. Many customers have adopted the saddle system of storing to save space.

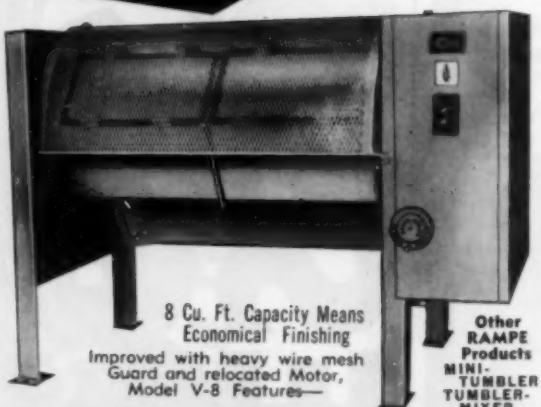
REPRINTS AVAILABLE

1. **What Is the Smallest Radius that Can Be Dressed with a Wheel Dresser?** by Henry F. Swenson.
2. **Where and How You Can Use Abrasive Rolls,** by Robert McAdams and James L. Erickson.
3. **Centerless Grinding,** by Editorial Staff of GRINDING and FINISHING.
4. **Organizing and Operating a Precision Barrel Finishing Department,** by Morris S. Shipley and William A. Biebel.
5. **Classifying Tool Steels by Grinding Characteristics,** by J. A. Weir.

Nos. 1, 2 and 5 are free of charge; Nos. 3 and 4 are priced at 35 cents per copy. Address GRINDING and FINISHING, 222 E. Willow Ave., Wheaton, Illinois.

VERSATILE — 1 to 4 Compartment BARREL FINISHER

RAMPE MODEL V-8



8 Cu. Ft. Capacity Means Economical Finishing

Improved with heavy wire mesh Guard and relocated Motor, Model V-8 Features—

INTERCHANGEABLE BARRELS—2, 4, 6 or 8 cu. ft. capacity for total capacity of 8 cu. ft.
DIRECT GEAR DRIVE—Improved Power—No Sprockets or Chains.
ADEQUATE POWER—1½ H.P. Magnetic Brake Motor with jogging and reverse switch.
NO-SEAM VINYL PLASTIC LINING for barrels, when desired, gives extreme wear and chemical resistance.

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STEELSET
SINTERED STEEL BOND
Diamond Wheels
(FOR WET GRINDING)

Cut faster • Last longer due to patented process of manufacture

Announcing:

ALUMINUM BODIES AT NO INCREASE IN PRICE
—for lightness, strength and dimensional stability. Available on most specifications of peripheral, cup and dish-shaped wheels.

NEW BOND MODIFICATION
—for improved non-glazing characteristics.

CUT-OFF BLADES UP TO 8 INCHES in diameter
Drills, blades, hones, lens laps, center laps, etc. We specialize in non-standard requirements. Send us your prints for quotation.

ATTRACTIVE PRICES • FAST DELIVERY

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Fish-Schurman Corp., 81 Portman Road, New Rochelle, N.Y.

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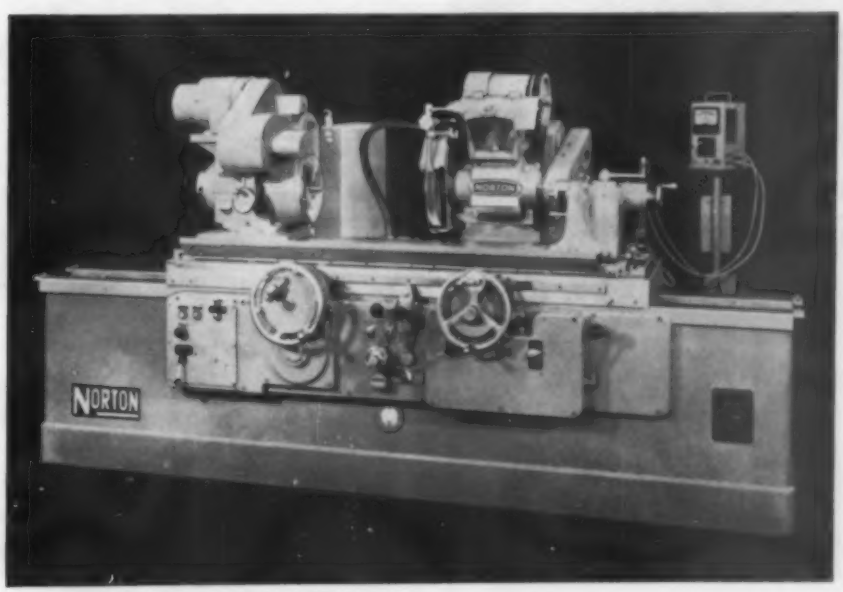
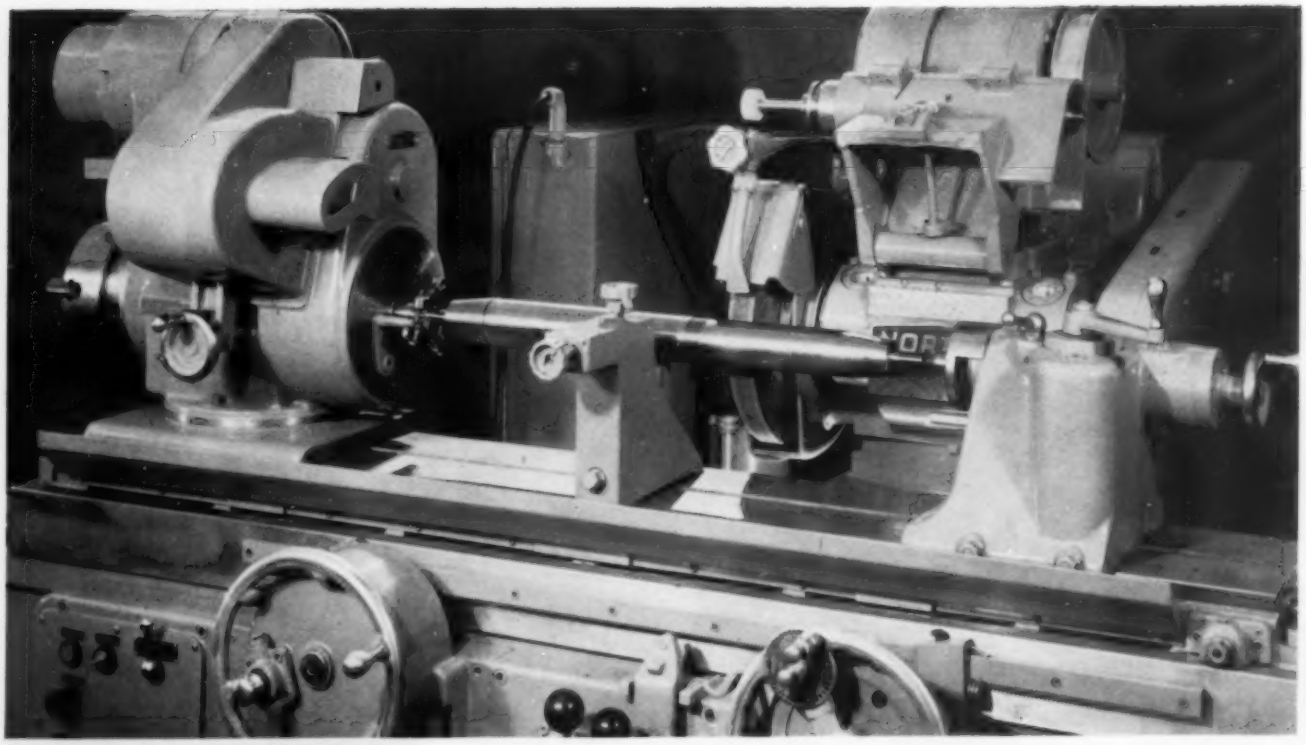
Norton Offers Increased Capacity In New Universal Grinder

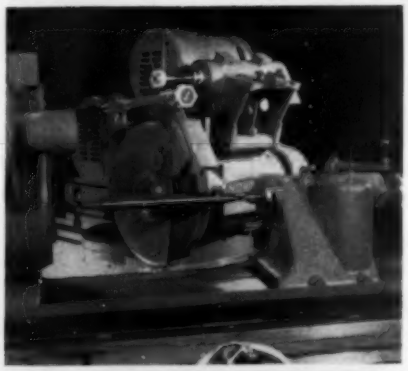
Norton Co., Worcester, Mass. announces their New Type U-4 Universal Grinding Machine line is now available in 14″ and 18″ capacities in work lengths of 36″, 48″ and 72″.

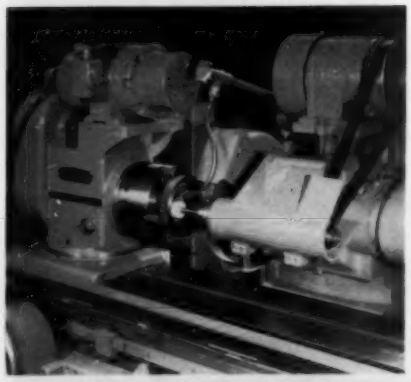
New features assure fast setups and rapid action in performing external, internal and angular grinding operations on large work pieces. In change-overs involving chucking, internal or dead center grinding, setup is particularly fast because a special feature simplifies the procedure. A chuck can be permanently mounted on the U-4. A 6″ D-1 cam lock nose on one end of the headstock takes chucks or special fixtures, and the other end is equipped with a dog drive plate for conventional grinding on centers. The change from conventional to chucking grinding only requires swiveling the headstock 180 degrees and chucking the workpiece.

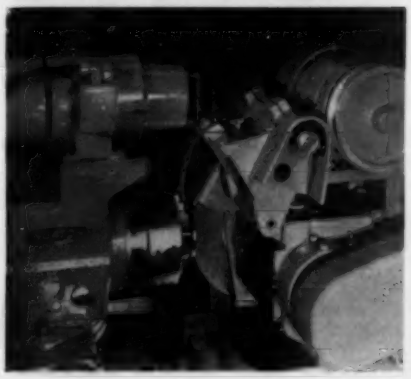
The advantage of permanent chuck mounting combines with that of the hinged-bracket type internal grinding spindle to speed setups for internal grinding. The individually powered in-











Closeup (top) shows Type U-4 Norton universal grinder set up for OD grinding with back rest. Views at left show Double swivel wheel head (offers independent angular settings for wheel position and wheel feed); alignment pad on headstock body visible in internal grinding setup; and face grinding a workpiece in permanently mounted chuck.

ternal spindle is quickly swung down into grinding position—or is easily swung back to the inoperative position. Time-savings from these advantages plus those from the ability to do an internal and external grind on a workpiece without disturbing the setup, assure consistently low job costs.

An infinitely adjustable work speed of 60 to 360 r.p.m. produced by mechanical means from an A. C. source, gives ample power throughout the entire work speed range and provides for wide job capacity. Speed changes are quickly made by a small hand wheel on the headstock.

Additional versatility is available in the wheel head which has a double swivel, one above and one below the slide ways. This feature permits independent angular settings of grinding wheel position and grinding wheel feed, thus making it possible to set the wheel at any angle and to feed at any angle—an important advantage in many special jobs.

The automatically lubricated wheel spindle is a plain bearing type in which the long bearings enclose practically the entire circumference of the spindle and support over 50% of the spindle body. Heavy cutting, or the finest finishing, may be done at will with this spindle. A wheel 14″ x 1½″ is standard with a 20″ x 1½″ wheel size available, according to the manufacturer.

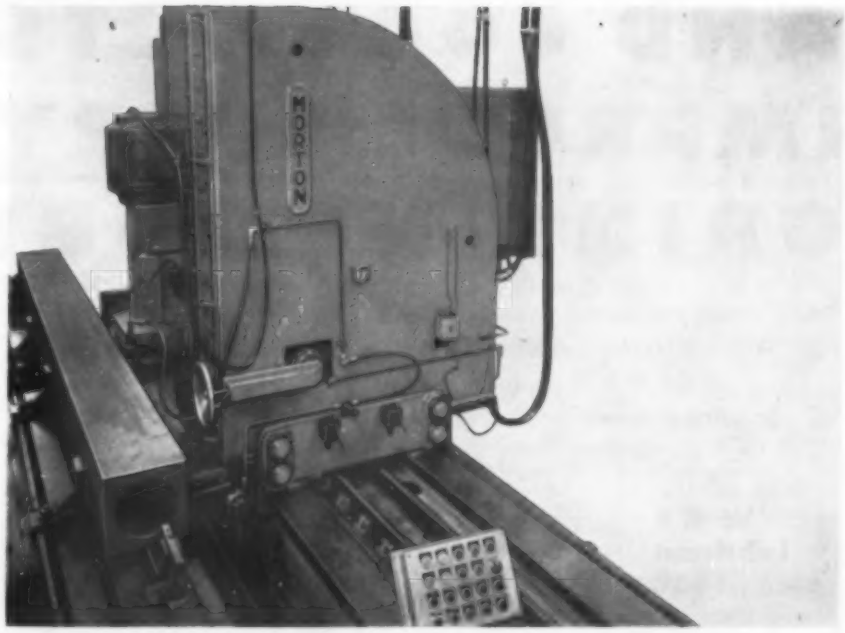
A combination lever and hand wheel operated footstock is supplied as standard. In lever operation, the footstock spindle will remain in the retracted position while loading. Pressure lubrication of all ways; electrical controls grouped in an elevated enclosure; accessible mounting of pumps and motors, and a ramped outlet in the coolant tank are additional features. The machines conform to J. I. C. Electrical and Hydraulic Standards.

An automatic grinding cycle arrangement and a power wheel head positioning mechanism are available at extra cost. The Norton Swivalign Dual Electric Indicator can be furnished with these machines for quick, accurate taper setting and for maintaining swivel table alignment accurately.

Use HANDY Postpaid Card. Circle No. 101

Special Heavy Duty Surface Grinder

The Morton Mfg. Co., Muskegon Heights, Mich. announces a new special heavy duty grinding machine for grinding long members. It can grind either straight surfaces or long-curve irregular surfaces to template.



The machine is basically a traveling wheel type with the work remaining stationary. A rugged compound saddle is mounted on the bed and is moved longitudinally along by means of a heavy duty roller type chain driven through sprocket and worm reduction by a variable voltage or reversing motor. This drive gives smooth power in varying speeds up to 100 feet per minute.

The compound saddle provides a means whereby the grinding column, on which the vertically movable spindle is mounted, can be moved toward or away from the work a distance of 24". It is provided with automatic "in" and "out" cross feed and with automatic vertical adjustment of the spindle. The spindle is mounted to rotate in the vertical plane and is arranged so that grinding can be performed either on the periphery of the wheel or with cup grinding. Spindle power is 30 H.P. at 1200 RPM.

With this type machine any length of bed can be used. The one illustrated is 30 ft. long with 22 ft. of working travel. Provisions are made in a permanent installation for tying work table and base together for incorporating suitable coolant collection and return in the foundation.

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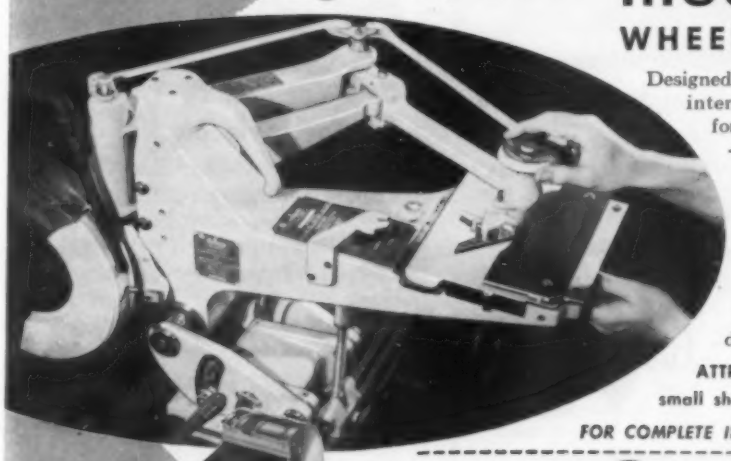
NOW! SAVE HOURS CYLINDRICAL FORM GRINDING

using the NEW PRATT & WHITNEY model 10 diaform WHEEL FORMING ATTACHMENT



Designed particularly for use on universal, external and internal, cylindrical grinders, the Model 10 Diaform form-trues grinding wheels – ACCURATE TO TENTHS – in minutes. You'll save HOURS of work performed by your highly trained, highly paid employees.

Mounted on the machine table, the Model 10 is out of the way during grinding, but quickly available for truing or re-truing. In operation, a tracer is lightly traversed over an easily-made template; path of tracer is transmitted at a 5:1 reduction ratio to the chisel shaped truing diamond which dresses as it form-trues. Grinding wheels up to 14" diameter and 2" wide can be formed.

ATTRACTIVE, LOW PRICE! Quickly pays for itself in large or small shops. NOW AVAILABLE FROM STOCK!

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PLUNGE GRIND PRECISION PARTS LIKE THIS IN MINUTES!

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Please send my free copy of P&W Circular No. 596.

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W&B LUBRICANTS AND COOLANTS IMPROVE EVERY GRINDING JOB!

Sixty-seven solid years of *specialized experience* stand behind White & Bagley Grinding Lubricants and Coolants. Here are some of the W & B products that are *boosting production, reducing grinding costs,* and *producing better finishes* for more and more plants throughout the world:

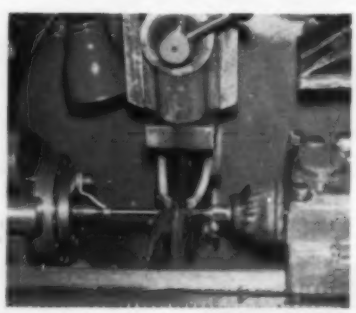
W & B Lubricant 1888 insures rapid and clean stock removal; keeps wheels open and free-cutting; permits the use of finer wheels to produce smooth finishes.

W & B Grinding Concentrate 1500 transparent and foamless; gives unusually keen grinding action and rapid chip settling; for grinding ferrous metals.

Courtesy, Norton Company

W & B Grinding Lubricant E-1 produces the highest reflective finish; permits rough grinding and finishing with the same wheel.

W & B Grinding Oil 1572 for close-tolerance, critical oil grinding; especially desirable on machines which perform a wide range of oil-grinding operations.



Courtesy, Jones & Lamson

W & B Base L adds potency (sulphur and fat) to petroleum or cutting oils to give improved results in grinding and machining.

Let us help you with *your* needs for grinding lubricants and coolants. We specialize in *your* requirements. For further information, mail the coupon today!

THE WHITE & BAGLEY CO.
Worcester, Mass. Detroit, Mich.
Originators of Grinding Lubricants

W+B INDUSTRIAL LUBRICANTS

The White & Bagley Company
Worcester, Mass.
Please send us more complete information on

☐ 1888 ☐ 1500 ☐ E-1 ☐ 1572 ☐ Base L

Name_____ **Title**_____

Company_____

Street_____

City_____ **Zone**____ **State**_____

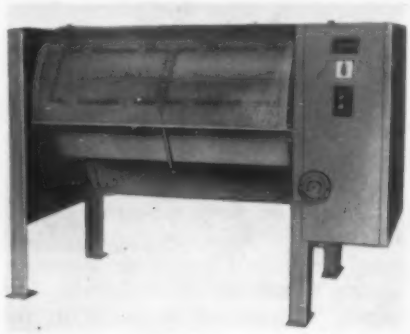
Circle No. 233 on postpaid card

Improved Model Barrel Finisher

For greater convenience and visibility Rampe Mfg. Co. has redesigned Model V-8 Barrel Finisher. The motor is now located at the rear of the machine where it is protected from water splash. The speed control handle is conveniently located at the front of the machine.

Another improvement is the use of a heavy wire mesh guard instead of a solid sheet metal guard in front of the barrels. This guard lifts up and back for easy access to the barrels.

Model V-8 Barrel Finisher has a total capacity of 8 cu. ft. available in



any interchangeable combination of 2, 4, 6 or 8 cu. ft. barrels. Power is furnished by a 1½ H.P. magnetic brake motor with jogging and reverse switch. Other specifications include: Variable speed drive; waterproof start-stop switch mounted in the front panel; and anti-friction bearings. Barrels can be furnished with the well proven No-Seam vinyl plastic lining which gives extra wear and chemical resistance.

Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10, Ohio.

Use HANDY Postpaid Card. Circle No. 185

New Compound for Tool Grinding

International Chemical Co., Philadelphia, Pa. announces their new International Compound No. 48 for diamond wheel grinding of carbide tools and other specialized grinding operations.

According to the manufacturer, the high detergency of this new coolant eliminates gum formation on the grinding wheel and table which would retard free hand movement in off-hand grinding operations. It also precipitates grinding dust quickly and completely, regardless of the amount of stock removed. This continual cleansing action maintains a free-cutting wheel longer and increases wheel life.

An amine nitrite type concentrate, Compound No. 48 dissolves readily in water to form a stable, transparent solution at all working concentrations. It

can be re-used indefinitely and has anti-rust properties that provide excellent temporary rust protection.

Compound No. 48 is recommended for offhand and plunge grinding as well as for operations involving high stock removal, such as in grinding cast iron.

For more information write to International Chemical Co., Dept. 217, 2628 N. Mascher St., Philadelphia 33, Pa.

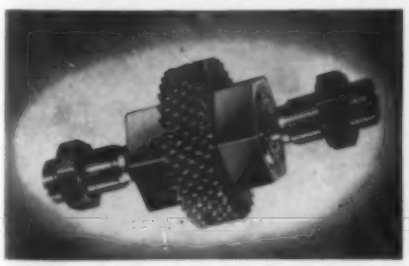
Use HANDY Postpaid Card. Circle No. 104

Abrasive Dresser

For better dresser performance at lower cost, there is now available a new, advanced functional design Type A Wise Dresser Cutter assembly. It lasts longer and picks, instead of crushes, the surface of the abrasive disc. These features provide lower cost abrasive dressing, according to the manufacturer.

Two types of cutting wheel assemblies (as shown) are interchangeable on the same basic arbor, giving this dresser broader application possibilities for longer service life and better results. The standard type has a cutter blade assembly made up of six wheels with all fine teeth. This is particularly suitable for dressing softer abrasive discs. The type A has three wheels with fine teeth and three wheels with alternate fine and broad teeth, as illustrated in the photograph. It is ideal for dressing hard abrasive discs.

The fine teeth on both styles of dresser assemblies pick abrasive grain from the surface. This sharpens without changing the grinding characteristics. The manufacturer states that the broad teeth on type A prolong the life of the dresser cutters. Another feature of the Wise Type Dresser Cutter is the tru-square arbor. The square design overcomes one of the chief disadvantages of other cutters which tend to chew



the keyway holding them on the arbor spindle and wear out the spindle long before the cutter itself is worn out.

Almost frictionless rotation of the cutter assemblies is assured by sealed ball bearings holding the square arbor. Buttons pressed into the side of each individual cutting wheel eliminate the need for spacing washers, and speed assembly and replacement. Besly-Welles Corp., So. Beloit, Ill.

Use HANDY Postpaid Card. Circle No. 105

Detachable Abrasive Strip

The Commonwealth Engineering Co., Dayton, Ohio announces a newly invented detachable abrasive strip which makes it possible to use lightweight, aluminum grinding wheels.

The new abrasive strip, which consists of abrasives set vertically in heat-resistant plastic on a fiber base, can be manufactured either as a flat sheet, to specific grinding shapes or as a sleeve which can be cut to the proper size. Either flat or grooved (for a cooling agent) light weight wheels can be used. The manufacturer claims that the wheel design will make it simple to fasten a new abrasive strip whenever needed.

Use HANDY Postpaid Card. Circle No. 106

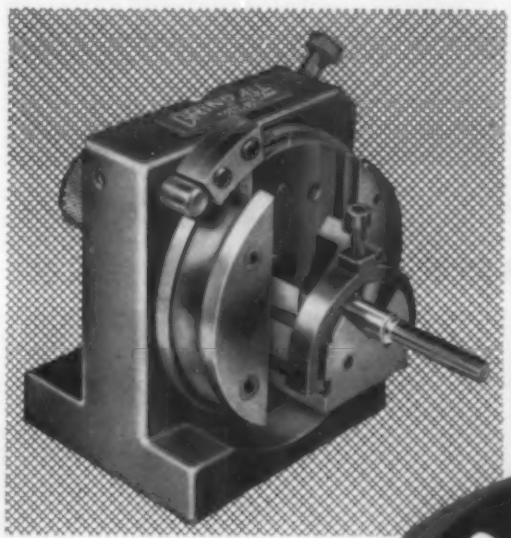
Comfort Feature of New Safety Shields

Joseph Buegeleisen Co. announces a new Buco line of face shields and helmets designed for comfort while offering maximum protection for the industrial worker.

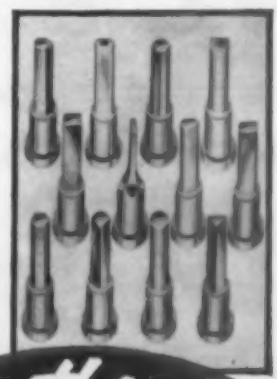
The new line of face shields affords conventional hat comfort through a 3-way adjustment to give a perfect fit to every head shape and size, according to the manufacturer.

Seven different head gear styles and eight window sizes are featured.

Use HANDY Postpaid Card. Circle No. 107



Perforator Grinding
±.0002 with greatest speed accuracy and range



the **Grind-All FIXTURE**

made by the house that precision built

Headquarters for the Finest... Precision Tools

Consult our engineering staff when you need precision tools or dies. Send for free catalog.

Harig Manufacturing Corp.

Here is higher accuracy, greater range and maximum speed in grinding perforators. Meets the requirement for a more versatile perforator grinding attachment. Grinds many irregular shapes concentric with shank.

Also performs other functions such as light milling and boring fixture, inspection tool, etc.

BORING FIXTURE

INSPECTION TOOL

Circle No. 234 on postpaid card

clear
transparent

K-7

NEVER LOADS THE WHEELS

K-7 solutions do not load work wheels, and this important advantage means (1) fewer dressings, (2) longer wheel life and (3) a true ground finish (rather than a burnished or smeared finish). In addition, with K-7 (because it does not load) you can often use a harder (1-2 grades) and finer (10-20 points) grit wheel, resulting in better work at lower cost.

Investigate K-7 for use in grinding all steels, cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. (Not recommended for non-ferrous metals.) It is an all-chemical water soluble liquid concentrate, transparent and colorless in solution. It is non-foaming and runs absolutely flat under all conditions. Low pH (alkalinity) makes it easy on the skin. Send for details.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit K-7 users can check the concentration of the solution right at the machine. Only takes a minute or two.

THE Lusol.. LUBRICANT
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 218, PORTLAND, CONNECTICUT

Circle No. 235 on postpaid card

Honing Machine Has Electronic Speed Control

A new honing machine developed by National Pioneer, Inc. of Muncie, Ind. offers feed and speed control from 100 to 1600 rpm using limit switches and variable speed motors. Automatic loading of workpiece is another feature which can be engineered to part characteristics and customer's specific requirements.

Automatic cutting speeds start with a low rpm for roughing, and when the part is within a predetermined ten-thousandth of finish size a high rpm automatically takes over to produce a low micro finish.

Automatic sizing not only ends the honing cycle when desired size is reached but also permits the operator to visually explore the bore during honing. Pioneer Automatic Sizing is a pneumatic honing and measuring device operated by air gaging.

Stone pressure control is also automatic, to give proper cutting pressure as determined by stone characteristics and part specifications. Stone pressure is variable over a wide range, and dangerous over-loading is prevented by the pneumatic circuit.

Stone feed up is automatic and integral with the stone pressure control, eliminating repeated stone adjustments to compensate for stone wear. Automatic stone use-up control enables you to get maximum usable stone life out of your honing stones and at the same time prevents either part or mandrel damage by stopping the machine cycle when the abrasive is completely worn down.

Segregation of parts according to various sizes is not ordinarily required due to the remarkable size repeatability obtained with Pioneer Automatic Sizing. If several sizes are desired, automatic air-gage sorting is available.

Use HANDY Postpaid Card. Circle No. 108

Stand for Model 12 Lapmaster

A new 36" wide x 32" high x 24" deep stand is now available for Model 12 Lapmaster Lapping Machines. The

stand is for use with either new machines or those already in the field. It is not only a convenient and space-saving work table for the Model 12 Lapmaster, but also provides handy inside storage space for compound, vehicle, polishing stand, monochromatic light, other fixtures and parts.

Sides of the new stand are made from 12 gauge steel, top from ¼" steel plate. Welded construction is used throughout. Two steel doors with locks and mounted on piano-type hinges give access to the two-shelf inside storage compartment.

Further information on the Model 12 Lapmaster Lapping Machine Stand is available from Crane Packing Co., Dept. GFN, 6400 Oakton St., Morton Grove, Ill.

Use HANDY Postpaid Card. Circle No. 109

Mobile Dispenser for Lubricants

Transporting and dispensing coolants, hydraulic and cutting oils or solvents can be accomplished by one man with the CeCor mobile dispenser manufactured by Coolant Equipment Corp., Verona, Wisc. The tank unit, mounted on 12 inch rubber tire or 30 inch steel wheels, has a capacity of 80 gallons and is available with either hand or electrically operated 15 GPM pumps.

One or two way pumps may be specified on all models and the electrically operated Model 210 is also available with valving which permits the mixing of liquids within the tank. Stainless tanks, larger tank capacities or multiple compartment tanks will be available.

The Model 220 (hand operated) can be equipped with gallon stroke or diaphragm pumps. Gasoline powered or air motor driven pumps may be ordered in place of the electrically driven pump.

Anti-splash baffles within the tank contribute to handling ease as well as provide reinforcement. The mobile liquid dispenser is especially useful in plants where aisles are crowded or narrow as it turns in a 48 inch circle.

Use HANDY Postpaid Card. Circle No. 110

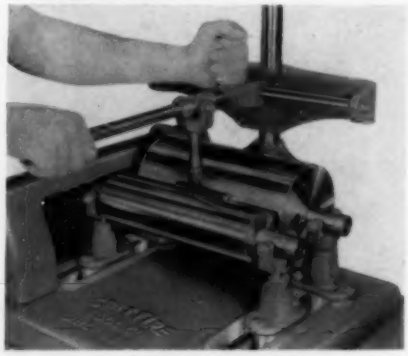
HANCHETT new HY-POWER grinder
for
SHEAR BLADES · KNIVES · FLAT SURFACES

HYDRAULIC TABLE DRIVE
MOTORS: 30 h.p. to 75 h.p. CAPACITY: 60" to 296"
GRINDING WHEELS: 30" or 36" diameter segmental
FULL AUTOMATIC CONTROLS • POWERFUL • ACCURATE
HANCHETT MANUFACTURING COMPANY
World's Largest Manufacturer of Knife Grinding and Saw Sharpening Machinery
MAIN OFFICE — Big Rapids, Michigan WEST COAST — Portland 1, Oregon
HANCHETT GRINDERS BIG RAPIDS MICHIGAN

Circle No. 236 on postpaid card

Over-Arm Attachment Gives Roller Lappers Added Precision

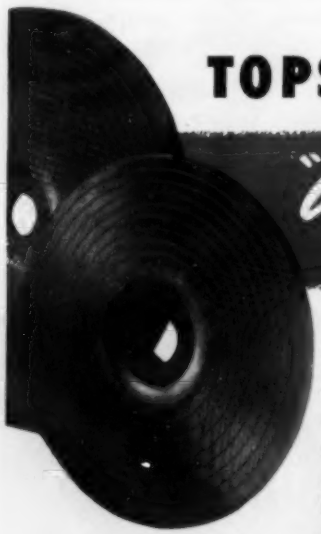
Spitfire Tool Co., Chicago, announces the new Versa-Grip over-arm attachment. This unit permits exacting control during lapping by holding parts down to lapping surface.



The new unit has been engineered to easily attach to any Spitfire Roller Lapping Machine now in use. Designed on the fulcrum principle, the Versa-Grip enables an operator to use less effort to apply greater pressure on piece parts during the lapping operation. The pinpoint control enables operators to apply lapping pressure precisely where needed on the part.

Spitfire includes two pressure blades with each attachment. . . a pinpoint blade for removing tapers and ultra-precision lapping and an over-all blade that assures uniform pressure over parts up to four inches in length. For lapping longer parts, special blades are available. Construction is of cast iron and hardened steel. Spitfire Tool Co., 2931 N. Pulaski Rd, Chicago 41, Ill.

Use HANDY Postpaid Card. Circle No. 111



TOPS FOR TOUGHNESS

"American" DURAFLEX

DURAFLEX DEPRESSED CENTER WHEELS

Heavily reinforced with strong fabric bonded with resins, these rugged wheels are made for a wide variety of operations such as: rough grinding, reducing heavy welds, undercutting and notching. They're light and safe . . . cut fast at high speeds with less operator fatigue. In two sizes, 7" and 9" diameter, 3/16" or 1/4" thickness.

DURAFLEX CUT-OFF WHEELS

Specially engineered, Fiberglas reinforcement gives these wheels amazing strength. Use with confidence where breakage was once a danger. Now you can safely use cut-off wheels on operations where rough treatment is unavoidable. In sizes from 6" to 20" diameter.

DURAFLEX REINFORCED GRINDING WHEELS FOR HIGH SPEED PORTABLE TOOLS

These resin-bonded reinforced wheels, specially designed to use the full power of modern air grinders, may be safely operated at considerably higher speeds than conventional wheels with machines properly guarded. Highly break-resistant, they're ideal for heavy production grinding where high cutting speeds are a "must". Try them for faster stock removal. Available in all standard sizes; also special sizes to order. Write for illustrated bulletin describing these new Duraflex Grinding Wheels.

Write AMERICAN EMERY WHEEL WORKS
RED BRIDGE · · PROVIDENCE 1, R. I.

SPARK UP YOUR PROFITS WITH "American" GRINDING WHEELS

Circle No. 237 on postpaid card

Oil Mist and Smoke Precipitator

Oil mist and smoke generated by high speed grinders, screw machines and lathes is virtually eliminated by a newly announced precipitator according to the Electro-Air Cleaner Co.

Six models of the Electro-Air Oil Mist Precipitator with either horizontal

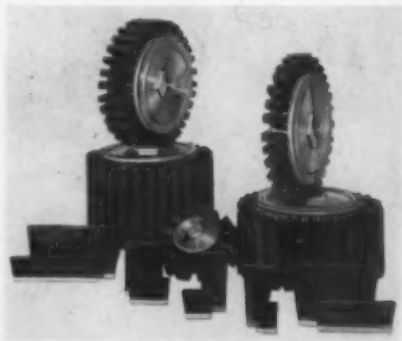
or vertical air flow are being manufactured in capacities of 800, 1350, and 2000 cubic feet of air per minute. A single Electro-Air unit can be mounted over one machine or in connection with a bank of high speed grinders or screw machines. Each unit is furnished as a complete "package" for quick and inexpensive installation.

Catalog OM-40 and price lists are available. Electro-Air Cleaner Co., 1285 Reedsdale St., Pittsburgh 33, Pa.

Use HANDY Postpaid Card. Circle No. 112

Narrow Brush Polishing Head

Newly added to the Vonnegut line is a series of brush-backed polishing heads that will sand, polish and debur flat and contoured surfaces on wood, metals and other surfaces. The heads are available with short or long bristle brushes in the 32, 16 and 12 brush models; the 32 brush head is now



available in a one-inch abrasive width, permitting the operator to get inside the most intricate wood or metal patterns. New Bulletin No. 102 describes operation and uses.

Grinding & Polishing Machinery Corp., 2530 Winthrop Ave., Indianapolis 5, Ind.

Use HANDY Postpaid Card. Circle No. 113

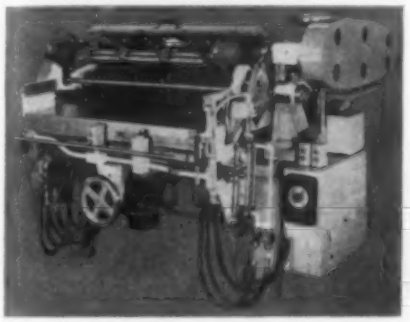
Surface Finishing Machines

A new series of surface finishing machines is now being produced by Clair Mfg. Co., Inc., Olean, N.Y.

These new models are known as No. 302, No. 304, No. 305, and No. 308.

The motor-brackets on the machines are different from predecessors. The castings for the motors are rear-mounted, which removes the over-hanging motor weights from the main pivot shafts, increasing sensitivity of the buff float for improved contouring.

The overall width of the machines have been reduced from 9'4" to 6'. The retention of interchangeability between



the 300-series and the 200-series surface finishing machines permits a smooth work flow between the new and older models without changing set-ups or tooling.

The new No. 302 model replaces the No. 202 double roll glazer and mirror polisher. The older No. 204 spoon and fork polisher, the No. 205 single spindle heeler and the No. 208 for curved handles are replaced by the new No. 304, No. 305, and No. 308 models respectively.

Use HANDY Postpaid Card. Circle No. 114

Portable Dust Collector

A new, square-type, portable DusKolector has been announced by Hammond Machinery Builders, Inc., of Kalamazoo, Mich.

Known as the Model 40, using a ½ H.P. motor, and mounted on casters

for portability, the new dust collecting unit is said to be ideal for capturing dust from medium size grinding equipment and to perform efficiently with drill presses, lathes, milling machines, surface grinders, etc., when these tools are used for high speed machining of cast iron.

The new Model 40 DusKolector is described as low in cost and requiring a minimum of space. Cabinet size is 25" wide x 22" deep x 28" high. Shaft with hand knob provides convenient means of "shaking" filters for cleaning without removing them from cabinet. Front panel easily removed for access to replaceable fiber glass filters and dust pan in bottom of cabinet.

With two inlets, the Model 40 has a capacity of 700 C.F.M., and can be used with two size 16" x 2" grinding wheels or two 4" wide abrasive belts. Advantages claimed are protection of the operator and of nearby tools from abrasive dust, reduction of cleaning and maintenance time, longer tool life, and rapid repayment of the original investment.

Hammond Machinery Builders, Inc., 1651 Douglas Ave., Kalamazoo, Mich.

Use HANDY Postpaid Card. Circle No. 115

Liquid Tumbling Compound

A new liquid organic tumbling compound has been announced by Finger Lakes Chemical Co., Etna, N. Y.

According to the manufacturer, Organ-Tu, the new compound does away with the need of several compounds and handles all types of work from rough deburring to precision grinding and burnishing. It functions equally well and without attack on any and all parts—steel, stainless steel, copper, brass, zinc, aluminum, silver, plastic and rubber.

Use HANDY Postpaid Card. Circle No. 116

NOTICE

to users of spindles* that need repair or rebuilding

POPE — the leading builder of precision spindles IS THE BEST PLACE TO HAVE YOUR SPINDLES MADE GOOD AS NEW.

Today's grinding, milling and boring tolerances demand precision spindle performance.

Pope puts your spindles in shape *quickly*, at lowest cost. (Cost figures are promptly submitted for your approval before the work is done.)

The same expert craftsmen that build Pope Precision Spindles will assemble, preload and lubricate the proper bearings and dynamically balance. The job will be done *right* the first time.

Send Your Spindles for Repair to POPE

Spindles repaired and rebuilt by POPE are assembled in an electrically air cleaned, air conditioned room. They are dynamically balanced, as pictured, to the same tolerances as new spindles. This assures better surface finishes and smoother running spindles.

* POPE Repair and Rebuilding Service applies to ANY SIZE, ANY MAKE of Anti-Friction Bearing SPINDLES.

Belt Driven
Motorized
High Cycle

POPE MACHINERY CORPORATION
261 River St., Haverhill, Massachusetts

Mail me a copy of Bulletin R-1 describing in detail Pope Precision Spindle repair and rebuilding service:

Name.....

Company.....

Address.....

City.....Zone....State.....

No. 114

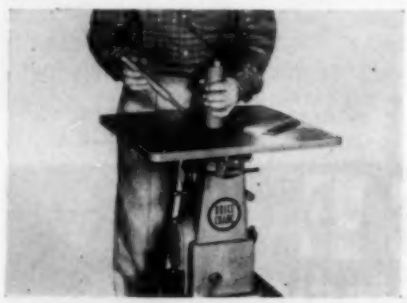
Circle No. 238 on postpaid card

Oscillating Spindle Sander-Grinder

A new model oscillating spindle sander-grinder, utilizing abrasives on work spindles under ¾" diameter, has just been announced by Boice-Crane Co., Toledo. It is provided with spindles ¼", ⅜", ½" and ¾" in diameter.

With the new smaller diameters scroll-grill work or small radius contours can be machine finished.

A second new feature speeds chang-



ing the arbors or drums carrying the abrasive sleeves. All arbors have taper-shanks which install instantly into a new taper-socket type main spindle.

Still another advantage claimed is that the drums for abrasives over ¾" diameter may remain permanently on the new type spindles. The complete arbor, drum and abrasive assembly installs or interchanges with another size.

Free literature will be sent to anyone addressing his request to Boice-Crane Co., 936 Central Ave., Toledo 6, Ohio

Use HANDY Postpaid Card. Circle No. 117

Polishing Lathe

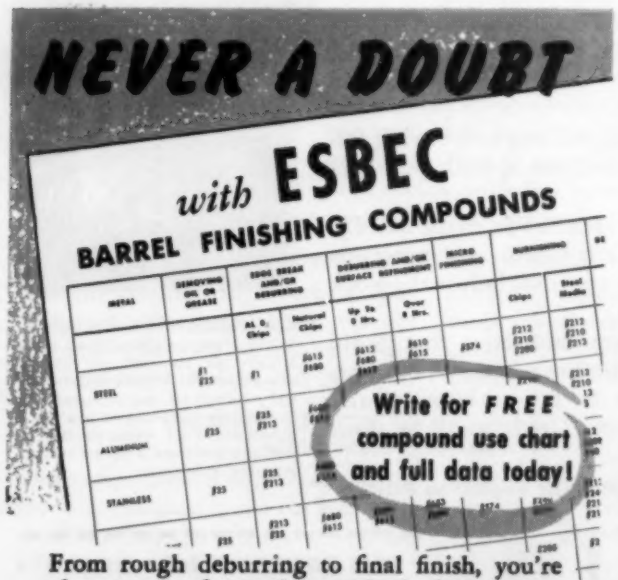
A new high speed polishing lathe with shortened spindle, for hand finishing small parts is announced by Hammond Machinery Builders, Inc., Kalamazoo, Mich.

The new lathe, designated as Model 5-ROL uses a 5 H.P. motor and has a speed up to 6500 R.P.M. The ball bearing spindle is dynamically balanced, uses either flat or multi-V-belt drive with motor mounted inside heavy cast iron base. Drive belts are easily removable and can be replaced without removing or exposing bearings. The

unit has a combination brake and switch, operated by a single lever for instantly stopping lathe spindle and cutting off motor current before brake is applied. Brake also locks spindle for wheel removal. Overhanging base permits handling of parts without base interference.

Hammond Machinery Builders, Inc., 1651 Douglas Ave., Kalamazoo, Mich.

Use HANDY Postpaid Card. Circle No. 118



From rough deburring to final finish, you're always sure of superior results in less time at lower cost with Esbec Compounds:

- ★ *Full selection for every operation and every material.*
- ★ *Color-coded for easy, quick identification.*
- ★ *Performance and economies proven throughout industry, and under all water conditions.*

EQUIPMENT COMPOUNDS ABRASIVES

ESBEC BARREL FINISHING CORP.

202 Beech St., Byram, Conn.

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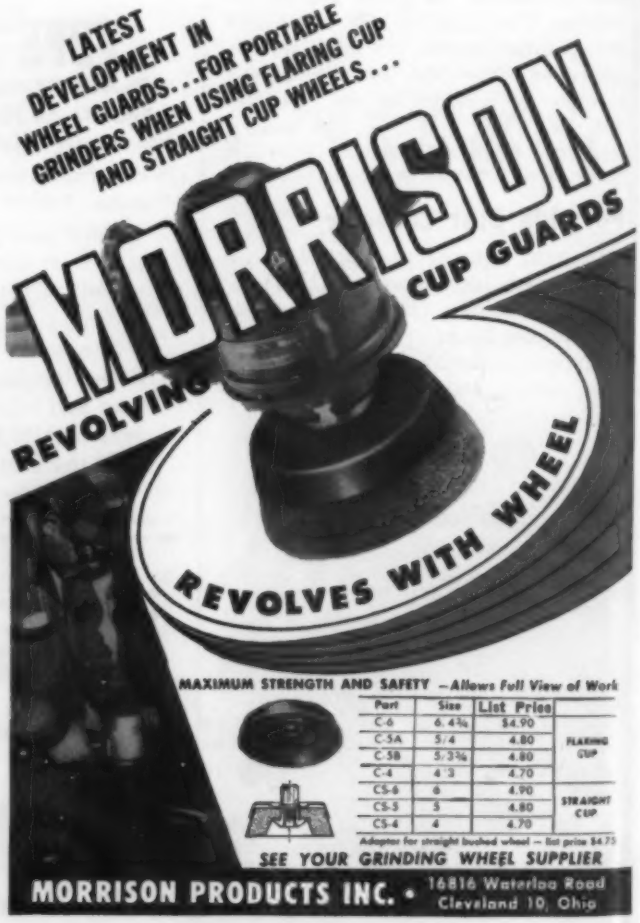


Circle No. 240 on postpaid card

New Air Gage Standard in Ball Bearing Industry

This new Sheffield radial play air gage has become a standardized instrument for simplifying and speeding the checking of internal clearances between inner and outer rings of ball bearings used by the millions in aircraft, automotive and other precision industries.

At the inspector's press of a pedal a controlled air stream does the measurement job in this newest precision measurement device, shown in use here by Lehman Rogers, tool engineer at Chance Vought Aircraft, Inc. The

column Precisionaire, right, is used with the gage checking device to measure radial play to tolerances of one ten-thousandths of an inch, or less, to meet the ball bearing industry's greatly increased precision requirements. The Sheffield Corp., Dayton 1, O. •

Use HANDY Postpaid Card. Circle No. 119

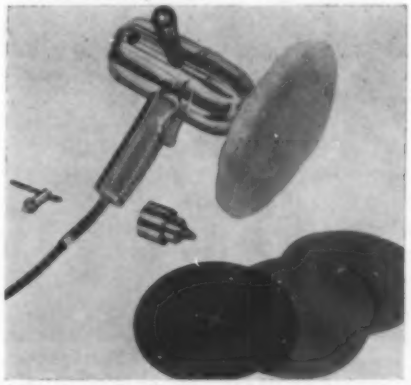
Portable Electric Polisher and Sander

Thor Power Tool Co., Aurora, Ill. has added two new SpeedTools to its line. Model 36 is a powerful, compact car and home SpeedPolisher equipped for both polishing and sanding. Weighing only 4½ pounds, it has a large offset handle and a removable side handle. It is ideally suited for wood sanding and polishing and for fast application of standard cleaners in automobile polishing operations.

This tool is supplied complete with all necessary accessories for polishing and sanding, as well as a ⅜" geared chuck for drilling. It is also available in a kit which includes a wider assortment of basic accessories, plus drill bits, wire brush, paint stirrer, polishing powder and combination steel carrying case and wall rack.

Model 35 SpeedDrill has a ⅜" capacity in steel and a ¾" capacity in wood. It is equipped with a geared chuck and features ball bearing construction.

Additionally offered as the Model



35K SpeedDrill kit, this tool has the same polishing and sanding attachments as Model 36, plus a bench mounting stand, drill bits, wire brush, cloth buffer, paint stirrer and combination carrying case and wall rack. •

Use HANDY Postpaid Card. Circle No. 120

Wet Surface Grinder

Originally planned for the automotive service field, the new model 117 wet surface grinder has engineering features, such as its ability to hold to tolerance of .0002", which make it attractive for many jobs in production and in the tool shop. The grinding wheel is 16" in diameter and takes work up to 42" high and 72" long. Feeds on both the spindle and the table are automatic, and machine completes full cycle without attendant.

Head raises and lowers on hand scraped ways driven by geared head motor. Portable coolant tank is mounted on wheels. Spindle is mounted on two pairs of precision ground, angular contact ball bearings. Motor is 10 h.p. axial air gap type, 1730 r.p.m. Base length is 144". Table length 106" with table width 30". Tillis Mfg. Co., Elkhart, Ind. •

Use HANDY Postpaid Card. Circle No. 121

Here's Your Answer —

ROYAL MASTER CENTERLESS GRINDER

Low Cost!

Meets demand for Centerless Grinder with full capacity range from .004" to 1½" O.D., at a 50% lower price.

Tolerances of .0002" are readily held.

6 - 8 microfinishes are easily obtained.

Now, with the Royal Master Centerless Grinder, you can do Precision Centerless Grinding in the entire .004" - 1½" range, from Tungsten Carbide to Plastics, with just one low-cost machine.

In addition to the range and quality of its work and its low cost, the Royal Master Centerless Grinder brings you bonus production features: low maintenance and operating costs, floor-space requirements of only 24" x 48", exceptional accessibility of work zone to both hands of operator, and a setup time down to ½ of the previous minimum..

Get all the facts. Write today for our 6 page descriptive brochure, illustrating and describing in detail the Royal Master Centerless Grinder, and showing examples of its work. No obligation.

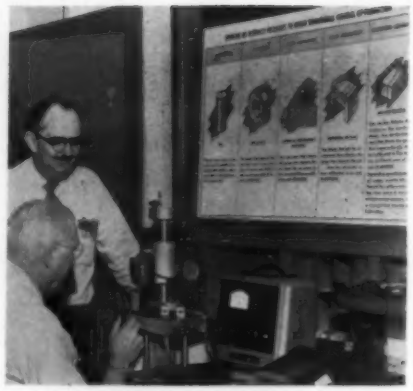
ROYAL MASTER INC.

200 STATE HIGHWAY 23, RIVERDALE, N. J.

Circle No. 241 on postpaid card

New Electronic Device Checks Master Measurement Blocks

As aircraft and other precision industries face the challenge of producing to closer and finer dimensions, even master and working gage blocks must be regularly inspected for dimensional accuracy. Here Lehman M. Rogers, left, and Harvey C. Griswold, tool engineer and gage laboratory engineer at Chance Vought Aircraft, Inc., conduct periodical inspection of dimensions of plant master and working gages and blocks, using a newly developed Sheffield electronic comparator. The unit calibrates the standard measuring gages and blocks to make sure their dimensions remain within desired limits. They're guided by Sheffield "Echelons of Accuracy" chart outlining step-by-step measurement safeguards for achieving dimensional controls as close as millionths of an inch. The Sheffield Corp., Dayton 1, O. •

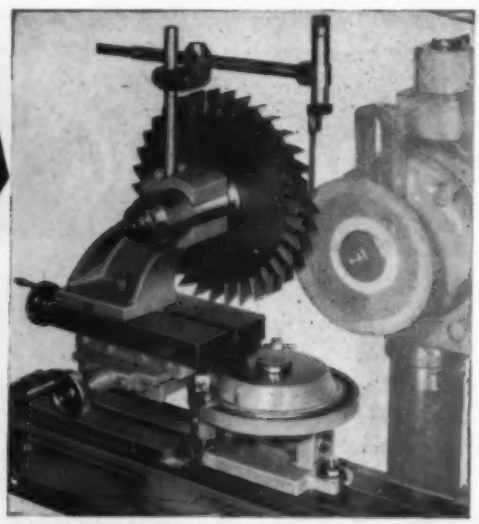


Use HANDY Postpaid Card. Circle No. 122

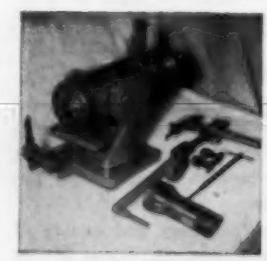
THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Does 5 Operations without removing cutter from its ARBOR!

On cutters up to 8" in diameter, the No. 6 fixture, as shown with our No. 6A heavy-duty, right-angle, ballbearing spindle workhead:
Sharpens side teeth on **both** sides.
Sharpens peripheral teeth.
Generates small or large radii on **both** corners of each tooth.
(Other workheads available)



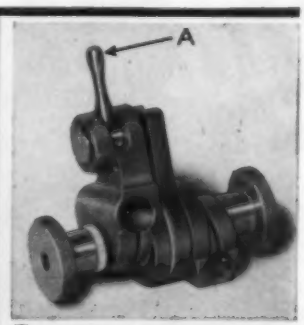
▲ THESE DEPENDABLE GRINDING FIXTURES SAVE THE LIFE OF YOUR CUTTERS. Write for our catalog 603



◀ UNIT 1A
This Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes. ▼

▲ UNIT 4A
Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.



▲ NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING. Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A".
WRITE FOR:
SLIDING SWIVEL FOLDER

ROCHELEAU TOOL & DIE CO.
650 North Main St., Leominster 1, Mass.

Circle No. 242 on postpaid card

Master Profiler and Contour Grinder

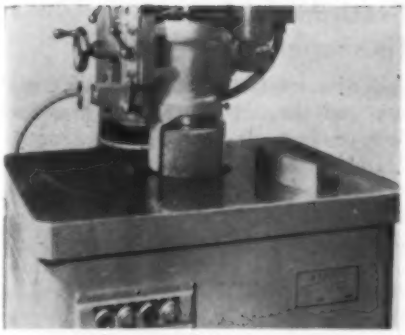
A new heavy-duty master profiler and contour grinder featuring ample power, rugged construction, large capacity, and unusual ease of adjustment has been announced by The Kindt-Collins Co., 12651 Elmwood Ave., Cleveland, O. It was designed for the fast removal of metal on steel punch or heavy press die sections.

A precision spindle supported by a heavy column and over-arm serves as the mounting for the grinding wheel. Wheels, including cup type, range in size up to 6" diameter by 4" height. Power is supplied by a completely enclosed 2 hp motor remote-controlled by push-button, and mounted on the over-arm at the top of the spindle housing.

The grinding wheel is oscillating (⅜-in. stroke at 72 opm) or non-oscillating at the option of the operator. The separate oscillating motor is also controlled by a remote push button. The wheel can be tilted from 0° to 5° by means of a hand-wheel adjustment and can be raised from table level to 10" above.

A specially-designed grinding wheel guard swivels on the spindle quill and locks in any desired position. Fast, accurate dressing of the wheel is accomplished by a diamond dresser which is an integral part of the machine. The wheel can be dressed without changing elevation of the head or degree of tilt. The grinder may be connected to either a dust collecting system or separate unit.

The heavy 24 by 30-in. cast iron table stands 37½ in. from the floor. It remains permanently horizontal and



is serrated to facilitate movement of the parts to be ground.

All wearing surfaces are protected against dust and grit by bellows. The spindle is equipped with grease-sealed super-precision bearings, requiring no lubrication.

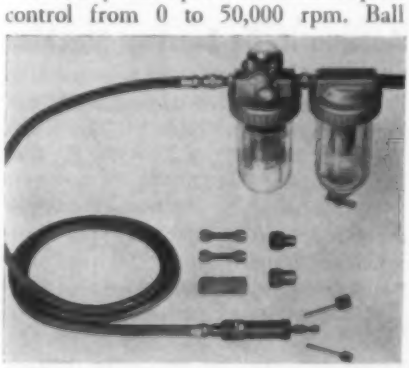
Overall dimensions are: 32-in. wide by 37-in. deep by 76-in. high. Base and cabinet of the machine is a one-piece unit of heavy fabricated steel, with 3-point suspension. Electrically equipped to JIC or NEMA standards. Net weight is approximately 1500 pounds; shipping weight approximately 1600 pounds. •

Use HANDY Postpaid Card. Circle No. 123

High Speed Grinder for Precision and Detailed Work

A new high-speed, vane-type grinder, not much larger than an ordinary fountain pen, is being offered by Buckeye Tools Corp., Div. 18, P.O. Box 966, Dayton 1, O., for precision detailed grinding in tool rooms and on production work. The Mini-Grinder is 3¼" long and weighs 3½ ounces. Rated capacity is ½" mounted point or grinding wheel; tool has ⅛" precision-ground collet.

A rotary valve provides infinite speed control from 0 to 50,000 rpm. Ball



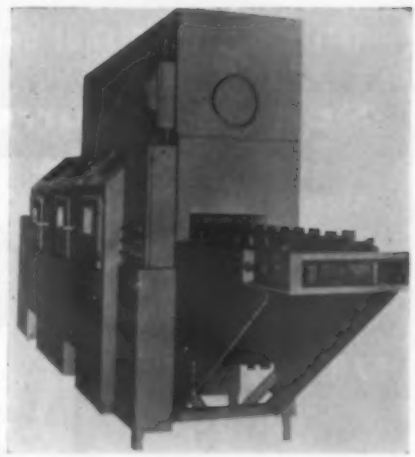
bearing motor mounts assure spindle precision. This new miniature grinder is available in a complete kit, with all accessories packaged in a specially designed sturdy tool storage box. Kit includes grinder, 3 nose pieces, 3 mounted points, 2 collet wrenches, dressing stone, 5 feet of air hose and couplings, and a fog-type filter-lubricator. A second kit includes similar accessories except the filter-lubricator; the tool is also available as a separate unit. •

Use HANDY Postpaid Card. Circle No. 124

Pressure Blast Unit Designed for Satin Finishing

A new, automatic pressure blast wet blasting unit featuring custom molded work holding devices, in-line conveyorization and automatic rinsing and drying has been announced by the Cro-Plate Co., Inc., 747 Windsor St., Hartford 1, Conn. This unit was designed for the decorative satin finishing of a highly polished flat aluminum sheet used in home appliance trim.

In operation, portions of the sheets, where brightness must be maintained, are masked by means of a silk screening machine. Laid in a horizontal position on the conveyor, the parts are blasted uniformly by means of a cluster of traversing guns. The following cabinet sections include a recirculating rinse station and air dry station.



A production rate of approximately 6 linear feet per minute is achieved on parts up to 20 inches in width. •

Use HANDY Postpaid Card. Circle No. 125

NEW The HD-700

THE ECONOMY DIAMOND TOOL for heavy duty grinding

Used in place of the single five carat or larger Diamond Tool and lasts longer.

NO RESETTING— Diamonds spaced regularly throughout, and as Diamonds wear away others take their place until Tool is worn out.

SPECIAL ALLOY— Wears just enough to permit Diamonds to maintain continuous free cutting surface.

PREVENTS GLAZING and WHEEL LOADING

WILL NOT FRACTURE

PRICE $39. each

Mounted on any Size Shank

The HD-700 — made of Special Alloy and impregnated with extremely hard uncut diamonds anchored firmly, is not only economical, long lasting, but withstands a terrific amount of abuse. It is used for rough, semi-finished and finished dressings on rough surfaces, external, centerless, and side wheel.

HAYFRED CO.

91 BROADWAY, SPRINGFIELD, MASS.

Circle No. 243 on postpaid card

it's the SHAPE that counts!

Speed-D-Burretts*

controlled size and shape **ABRASIVE MEDIA** for PRECISION BARREL FINISHING

4 Shapes to choose from

Outlasts other media as much as 10 to 1

Controlled grain size Aluminum Oxide bonded firmly with a specially formulated synthetic rubber to allow finishing of precision parts hitherto impossible to barrel finish. Molded and cured to a controlled hardness that assures long life and maximum cushioning yet gives desired cutting, honing or polishing action. New "Burretts" permit abrasive action in the most remote corners and recesses of delicate, precision parts. Will not chip or splinter into odd shapes, thus allowing barrel finishing of complicated precision parts without fear of loading or damage, also eliminating the slow, costly and continuous sizing necessary with other types of media. *May be used with any equipment.*

Write for catalog of prices, sizes, shapes and grits — today!

ALSO ASK FOR CATALOGS ON:

FUTURAMA LINE . . . 3 Custom-Styled Models for large, high production work needs. In popular barrel sizes.

MITY-MITE LINE . . . A unit for every size plant — for high production — or short runs, for large, small or intricate parts.

THE SPACE-MISER . . . A complete barrel finishing shop in one unit. May be installed in a very small work area.

MEDIA and COMPOUNDS . . . Speed-D-Burretts and all other known types and sizes. A complete selection for every barrel finishing requirement.

HANDLING EQUIPMENT . . . All optional handling, media storage, separation and other equipment for complete barrel finishing.

* Pat. Pend.

SPEED-D-BURR CORPORATION PRECISION BARREL FINISHING

SDB-85

THE WORLD'S MOST COMPLETE LINE OF PRECISION BARREL FINISHING EQUIPMENT & SUPPLIES

Service is our most important product . . . it does not cost — IT PAYS!

SPEED-D-BURR CORPORATION
3613-f San Fernando Road, Glendale 4, Calif.

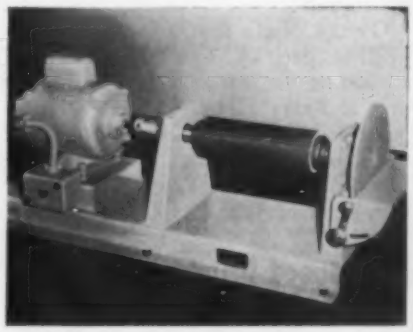
Circle No. 244 on postpaid card

Bench Model Rotary Finisher and Buffer

A new rotary finisher and buffer, announced by Mathewson Machine Works, Inc., 80 Hancock St., Quincy 71, Mass. has wide application for abrasive finishing, burring, sanding, buffing, and polishing of metal, wood, plastics, fibre, etc.

This machine is a versatile production tool that takes the place of makeshift arrangements. It was developed for use in the Mathewson plant and aroused so much interest from visitors that it was decided to make it available to others.

This compact bench model machine uses a standard hinged roll, and any



type of emery cloth, sandpaper, buffing cloth, etc. can easily be inserted. It is available with or without disc attachment. The work rest for the disc attachment is adjustable from 45° to 90°.

Specifications include: 1/3 hp, 110V, 60 cycle, 1 phase motor; rpm 1750, direct drive; overall size 35″ long, 12″ wide, 14″ high; shipping weight 90 lbs.

Use HANDY Postpaid Card. Circle No. 126

Automatic De-Burring Machine

A small machine to de-burr metallic or non-metallic parts automatically has been designed and built by The Klaas Machine and Mfg. Co., 4314 E. 49th St., Cleveland 25, O.

In this particular application, washers were de-burred at 3000 pieces per hour, whereas formerly about 60 per hour had been handled manually.

A hopper feeder positions the part so that the face to be machined is upward. From the feeder the piece goes through an escapement to an air-operated vise

which positions and holds the piece for de-burring. A drill head feeds, machines and retracts. The part is then ejected and the cycle starts over again. All operations are completely synchronized and automatic. In this application a chamfering tool of proper design is adapted to the drill head.

Use HANDY Postpaid Card. Circle No. 127

New Sanding-Disc Pad

An improved 8" rubber pad for feather-edging and blending contours in metal, wood or plastic surfaces has been developed for automotive, marine and industrial users by Behr-Manning Co. of Troy, N.Y., a division of Norton Co.

The new Behr-cat flexible pad, ⅜ in. thick, is made expressly to withstand rough treatment on slow-speed portable grinders and polishers, with a ⅝ in.-11 shaft, operating in the range of 900 to 1500 rpm.

Abrasive discs may be applied to the pad merely by coating it with disc cement and placing the disc against the work surface of the pad. A handy tube

of special high-tack Behr-cat disc cement accompanies each flexible pad.

Rugged in construction, this pad is made in three layers, all bonded together rather than cemented. This hub is counterbored so that the pad will seat securely on the shoulder of any slow-speed disc grinder or polisher spindle. To change discs, simply peel off the old one and apply a new one. •

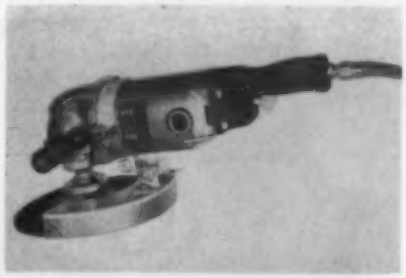
Use HANDY Postpaid Card. Circle No. 128

Lightweight Portable Grinder Features High Torque Motor

Streamlined outside, with permanently aligned and lubricated working parts, the new J & H portable grinder packs 2 hp into a tool weighing only 14 lbs. net.

This heavy duty industrial grinder with its high torque motor maintains perfect alignment through special manufacturing control and the complete use of sealed, pre-loaded ball bearings. Spindle thrust is taken by double-row ball bearings.

Large cooling fan and vent areas assure cool motor operation, and an automatic reset overload protection switch prevents damage to motor. Matched spiral bevel gears, rated for 10 hp operation, transmit the high torque to the grinding spindle. The magnesium housing and carefully balanced design give excellent ease of handling. Literature including price is available from J & H Products Co., 3007 Elm St., Dallas, Texas. •



Use HANDY Postpaid Card. Circle No. 129

New Coolant Compound for Tool Grinding Operations

A new compound for diamond wheel grinding of carbide tools and other specialized grinding operations has been developed and is known as International Compound No. 48.

According to the manufacturer, the exceptional detergency of this new coolant eliminates gum formation on the grinding wheel and table which would

WALKER . . . .

and a great industry

For more than fifty years automotive production has relied on Walker holding devices. One of the most popular chucks in the Detroit area is Walker 617 CG (concentric gap) type, a rectangular chuck that combines longitudinal and transverse gaps. Produced in sizes to meet all holding requirements.

Walker engineers can solve any holding problem.

What is yours?

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

Circle No. 245 on postpaid card

retard free hand movement in off-hand grinding operations. At the same time it precipitates grinding dust quickly and completely, regardless of the amount of stock removed. This continual cleansing action maintains a free-cutting wheel longer and increases wheel life.

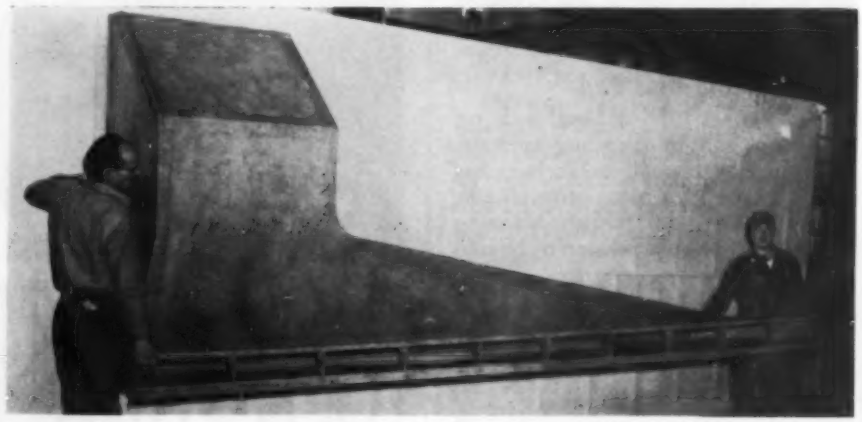
A scientifically formulated amine nitrite type concentrate, Compound No. 48 dissolves readily in water to form a stable, transparent solution at all working concentrations. It can be re-used indefinitely and has anti-rust properties that provide excellent temporary rust protection.

The compound is recommended for offhand and plunge grinding as well removal, such as in grinding cast iron. as for operations involving high stock International Chemical Co., Dept. 209, 2628 N. Masher St., Philadelphia 33, Pa. •

Use HANDY Postpaid Card. Circle No. 130

Light Weight Corrosion Resistant Fume Hood

This corrosion resistant fume hood measures 12½ feet long and weighs 178 pounds. Manufactured by Haveg Corp., 900 Greenbank Rd., Wilmington, Del., the hood can be lifted by two men, and is said to be stronger and more rigid than hoods weighing more.

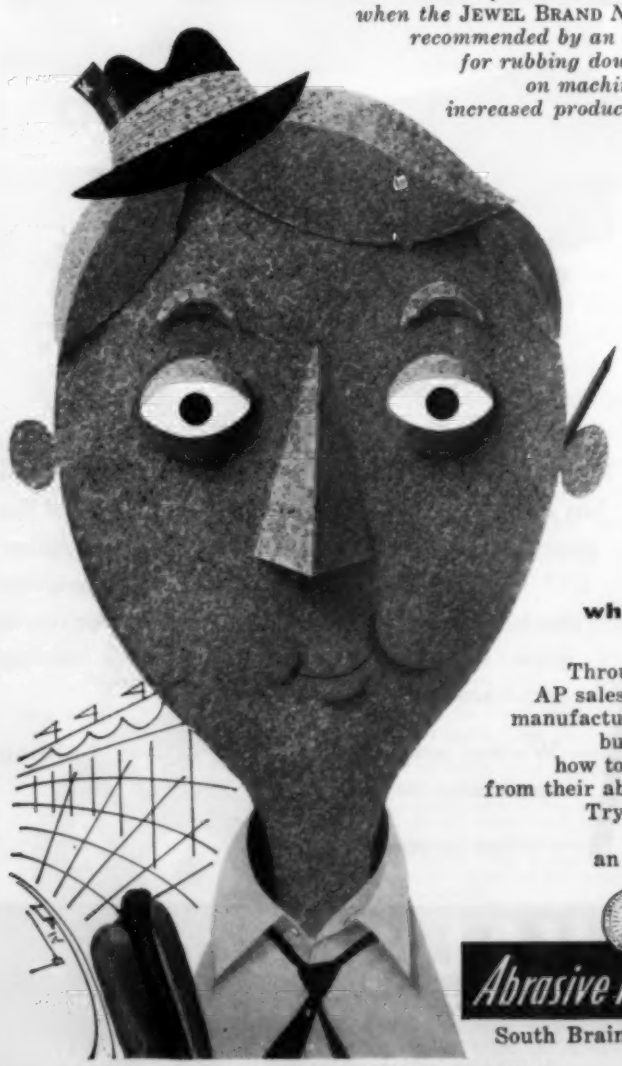


This polyester reinforced glass hood is claimed to provide greater corrosion resistance and was designed to handle strong acid fumes from electric plating. This is one of several polyester glass ducts recently introduced by Haveg Corp. Costs are claimed to be substantially less than stainless steel and service life several times greater. •

Use HANDY Postpaid Card. Circle No. 131

NO. 3 *"Roughing it"* with Reddy MacFlint

"What a finish! Some pinch hitter! That's just what a manufacturer said when the JEWEL BRAND *New Process Paper recommended by an AP salesman for rubbing down the filler coat on machine castings increased production about 100%."*



"Smoothing the way where the going is rough"

Through faster service, AP salesmen not only help manufacturers in a "pinch", but often show them how to get better results from their abrasive operations. Try this combination, if you have an abrasive problem.

Abrasive Products, Inc.

South Braintree 85, Mass.

Circle No. 246 on postpaid card

Two or Four Station Tumbling Machines

The Ultra Sheen Div. of B. W. McIntyre Co. of Reseda, Calif. has announced the perfection of the Johnny barrel finishing machine.

The Johnny is a 2 or 4 station tumbling machine which is well suited for deburring, burnishing or drying. It is available with 9" x 12" or 11" x 16" open-end, or 7 x 16 closed hexagonal barrels. These units operate horizontally for maximum slide action or are readily adjustable to less acute angles for controlled action.

These units lend themselves to efficient operation because of the fact that the working barrels may be left in

operation while the idle segments are being loaded or discharged. The barrels are lined with live rubber and the units have a built-in drain trough. • • •

Use HANDY Postpaid Card. Circle No. 132

Bias Cloth Buff Features Centerless Construction

A new "Centerless" Bias Cloth Buff, manufactured by American Buff Co., 2414 S. LaSalle St., Chicago 16, Ill., is engineered for high-speed volume buffing on automatic machines. In this design, the cloth is gripped securely by special Lok-Tite steel rings, leaving the center completely open for cooler air-conditioned running. This permits faster machine speeds without burning, thus greatly increasing production and lengthening buff life.

In addition to holding the cloth in a firm, even grip, the simplified design of the steel clinch ring permits the locking together of an almost unlimited number of sections. This enables the user to build up a buffing face of up to 12 inches or more in width, with complete safety.

Buffs are made from selected materials, in a wide range of densities and grades for cutting or coloring on aluminum, brass, copper, steel, die-cast, plastic, and stainless steel.

Use HANDY Postpaid Card. Circle No. 133

Tool and Cutter Grinder

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N.Y., eastern distributor of the Pedersen line, has announced the Model USL universal tool and cutter grinder.

This machine has a table size of 36 x 5½, with the main spindle rated at 3,800 to 5,750 rpm. It has a telescoping metal-enclosed spindle column. Special table and saddle bearing arrangement insures extremely smooth and free movement of the table.

Universal accessories including an all angle plate for compound grinding and for large cutter heads are optional. Also available are two separate dust collectors. One for dry dust collection and a more recent development, the wet grinding attachment, for use in conjunction with carbide grinding operations. •

Use HANDY Postpaid Card. Circle No. 134

Micro-Hardness Tester

A new combination micro-hardness tester and metallurgical microscope, of non-destructive type, with a load-weight range of from 25 to 1000 grams,

and requiring only one minute for a complete test cycle, has been announced by The Sheffield Corp., of Dayton, O.

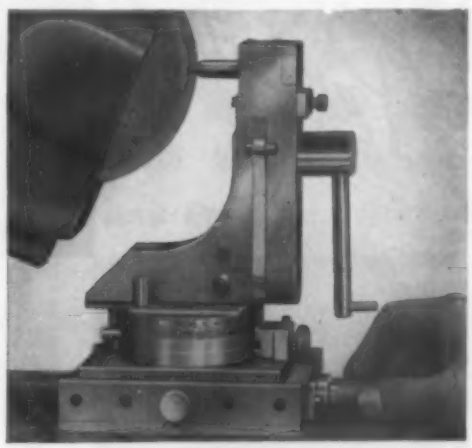
Interchangeable vise accessories permit this instrument to be used for testing small precision ground or lap-

Tough Grinding Wheel Forms Dressed Easy as A, B, C

eliminate elaborate set-ups and operations

.0001" ACCURACY

Fluidmotion
WHEEL DRESSERS
dress two angles tangent to a radius in one continuous motion



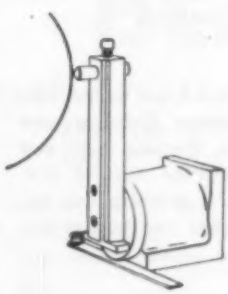
With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.

Adaptable to all type cylindrical and surface grinders.

A. Obtain micrometer reading; add required convex radius or subtract required concave radius.

B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.

C. Tighten jib. Set stops for two angles. Ready for action.



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave.

WRITE FOR INFORMATION ON THE NEW J & S PURCHASE PLAN
See your industrial distributor or write for free literature.

J&S TOOL CO. INC. — CLAMPCUT

J & S TOOL CO., INC. | 871 DORSA AVE. LIVINGSTON, NEW JERSEY

Circle No. 247 on postpaid card

ped parts, small diameter wires, very thin materials or material coatings, thin sheet stock, cutting tool edges and ball bearings.

Vertical capacity is 2-3/8", and the maximum spread of standard vise jaws is 1-11/16". Surface finishes of 40 rms or less can be inspected, and indentations of .0004" or smaller can be measured to within an accuracy of .00008". The spot to be indented can be located to within an accuracy of .0002".

The work piece is raised to the indenter by handwheel. A specially designed loading system, with the load applied in a direct vertical motion perpendicular to the work, eliminates indenter side thrust and deformed indentations which might cause incorrect reading of hardness value.

When the instrument is used as a metallurgical microscope, the interchangeable objective lenses provide magnifications of 200X and 400X. A camera can be attached to the eyepiece for making photomicrographs. •

Use HANDY Postpaid Card. Circle No. 135

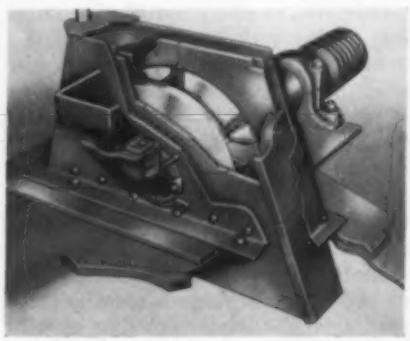
Blast Cleaning Machine Reduces Operating Costs

A new batch-type airless abrasive blast cleaning machine designed for improved blast cleaning efficiency and reduced cleaning costs has been introduced by Wheelabrator Corp., Mishawaka, Ind. This machine, known as the Super Tumblast, has an operating load capacity of 28 cu. ft. It is designed for cleaning sand, scale, oxides, and other contaminants from any work that can withstand a tumbling action.

One of the keys to faster cleaning is the hurling of a large volume of abrasive upon the work. This is accomplished by a single super-capacity airless blast unit that throws 830 pounds of abrasive per minute, making it possible to employ only one abrasive hurling wheel.

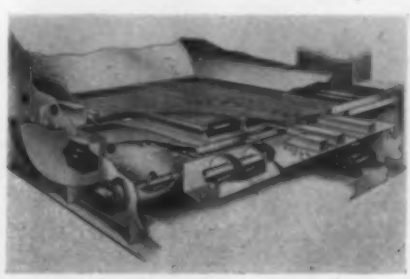
Overall view of the Super Tumblast.

The separator on the Super-Tumblast uses the air separation principle, and has three times the air separation surface found in older machine designs for similar loads. The separator makes certain that every pellet thrown is effective metal shot or grit and that the optimum abrasive mixture is maintained throughout the blast cycle. It is mounted at the bottom of the machine, rather than above it, for easy servicing.



The abrasive-hurling wheel, cut-away, so as to show how the blades are positioned.

The Super-Tumblast first batch-type cleaning machine is designed to provide the reliable performance required for automatic operation. It is readily converted to automation because of



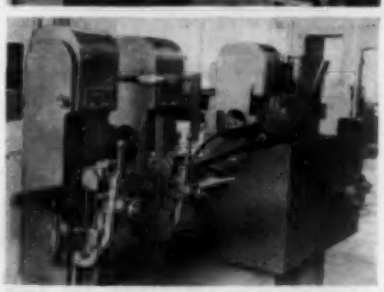
Cut-away view of the abrasive separator.

Production

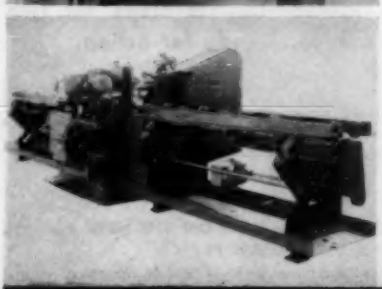
SEE OUR DEMONSTRATION

BOOTH 1809
NATIONAL
METALS EXPOSITION

A new machine to be shown for the first time is the Twin Belt Surfacing Machine with rotary feeding fixture. This machine is capable of grinding both ends of slug stock simultaneously and is so designed to accommodate many types of work feeding devices and conveyors.



Two Centerless Machines Type 486 and 484 joined in tandem will also be demonstrated showing a precision grinding operation and a two pass finishing operation on cylindrical bar stock. These machines operating as a unit will produce accuracy to .0005" T.I.R. and a low micro inch surface finish in a single handling.



Featured at the N.M.E. will be this new Type 614 Centerless Grinding and Finishing Machine. Precision built and of rugged construction this 15 H.P. unit is designed for grinding and finishing ¼" to 4" tubes and bars at fast production rates.

PRODUCTION MACHINE CO., Greenfield, Mass., U.S.A.

Circle No. 248 on postpaid card

standard power features. It has been successfully operated over long periods without the assistance or observation of an operator. A single push button will actuate the entire sequence from loading to unloading. In those cases where it is desirable to have an operator in attendance, he is free to handle more than one machine or perform other cleaning room tasks, permitting lowest possible direct labor costs. •

Use HANDY Postpaid Card. Circle No. 136

Pedestal Model Honing Machine Features New Improvements

A new and improved design of their combination pedestal model JCP honing machine and coolant unit has been announced by Superior Hone Corp., 1616 Elreno St., Elkhart, Ind.

New features include the enclosure of the coolant unit in the base, an increase in capacity to 10 gallons, a larger, expandable coolant tray working surface, and a V-belt drive. It has a honing range from .120 to 2.500, without adapters.

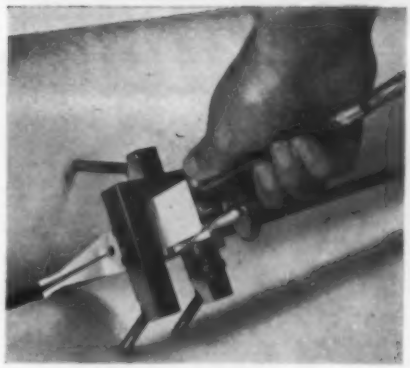
Spindle speeds are variable from 400 to 1000 rpm without changing belts. Mandrels or stones can be changed without the use of tools. All mandrels fit the spindle with a bayonet lock.

The counter-balanced foot pedal is adjustable to any desired pressure. The flexible coolant hose can be accurately aimed at any point, and the nozzle is adjustable to an oil flow that exactly fits the needs of any job. •

Use HANDY Postpaid Card. Circle No. 137

Air Gage For Correct Spacing Between Calender Rolls

An air-caliper gage that provides direct measuring for the spacing between calender rolls so that the user may determine whether the rolls have been ground correctly all the way across is being offered by Federal Products Corp. of Providence, R.I.



When calendering sheet plastic or similar material, uneven calender rolls will produce uneven sheets. This can be seen immediately when the material is packaged in rolls because even very small imperfections, when multiplied by the number of layers in the roll, become intolerable.

Federal Model A-149 P-1, is a portable caliper gage that contacts the rolls directly. The measurement is transferred from the caliper type contacts to an Air-Probe, air gaging spindle. Any variation in space between rolls is shown on a dial, which is connected to the Air-Probe through a plastic hose. Because there is direct mechanical contact between the gage and the crowns of the calender rolls, positioning is quick and positive. The locating bars or legs assure that the gage contacts penetrate to the proper depth. •

Use HANDY Postpaid Card. Circle No. 138

New Lightweight Flexible Shaft Machine

SJ38 is the designation for a new flexible shaft machine announced by Stow Mfg. Co., 30 Shear St., Binghamton, N.Y. The SJ38 is mounted on

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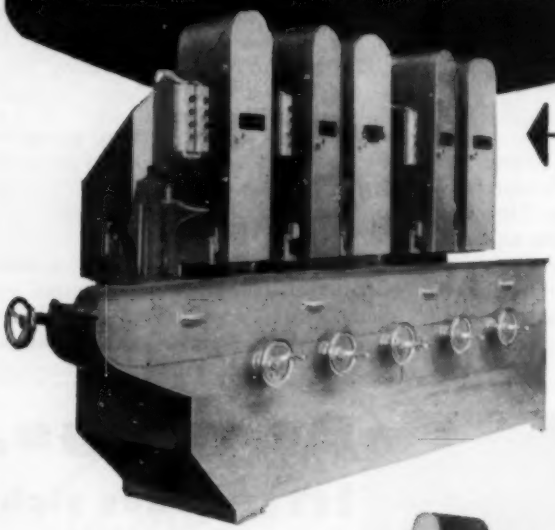
by grouping several operations on one

Engelberg Abrasive-Belt Grinder!



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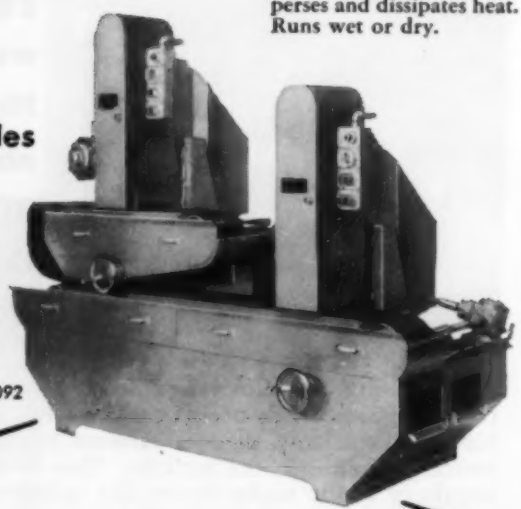
Piece-work first passes under grinding head at left, then is carried around bend to bottom conveyor belt. Unground face is now *up*, positioned for passage under second grinding head at right.

Model 2-1092



PRODUCTION INCREASES OF 100% AND UP are not uncommon with the high-production semi-automatic abrasive-belt grinders shown here. Fine finishing to close tolerances may be done on *any* ferrous or non-ferrous metal, plastic or other material.

Precision manufacturing of these and scores of other models has provided facilities and experience ideally suited to the solution of problems in abrasive grinding. Our methods-engineers will gladly go over your drawings or samples of typical production pieces for operational analysis—no cost or obligation. Just write.

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a pan and caster base with a carrying handle on top of the motor. Although the flexible shaft is very light and easy to maneuver, it transmits up to 1/3 hp.

Three speeds may be obtained with this machine: 1000, 1750, and 3000 rpm. Two of the speeds may be obtained by connecting directly to the motor or to the countershaft. The third speed is obtained by interchanging the pulleys.

The SJ38 can be used for buffing, sanding, wire brushing, drilling, reaming, and grinding. The belt and pulleys are completely guarded. It is available with either a 1/4 hp or 1/3 hp motor. This 3/8″ flexible shaft is built for long life, and the core is made of the highest grade of music wire. •

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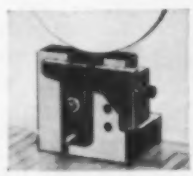
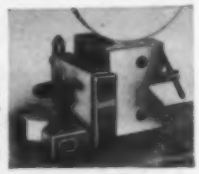
LASSY MASTER V-BLOCK ANGLE PLATES

This Master V-Block Angle Plate is an improved new design. Saves hours of setup time. Assures precise work accuracy. Requires less skill.

Side Gage automatically squares work precisely and without removing angle plate from chuck. Repetitive accuracy maintained.



Adjustable parallel holds the smallest work for position and clamping with ease and accuracy.



LASSY MASTER Angle Plate provides a master setup for regrinding of worn or inaccurate Angle Plates.

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PLAINVILLE, CONNECTICUT, U.S.A.

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New Grinding Coolant Filters

Six filters with capacities of from five to sixty gallons per minute for filtering heavily contaminated grinding machine coolants have been announced by Purolator Products, Inc.

The accordion pleated, plastic impregnated filter elements trap particles down to a size of 10 microns. Capable of removing either ferrous or non-ferrous metal particles, the new filters prevent scratching of parts being ground and provide protection for internal pump parts from metallic particles and abrasives.

The easily replaceable elements, according to Purolator, have an economical life while handling either water soluble oils or thread grinding compounds.

Available in capacities for handling five, ten, twenty, thirty, forty or sixty gallons of water soluble oil and lapping coolants per minute (halve each amount to figure capacity of filter for thread grinding coolants), the new filters largely eliminate production stoppages for purposes of cleaning tanks and changing coolants.

For further information on the PAG-25 through PAG-300 line of grinding coolant filters, write Dept. G, Purolator Products, Inc., 970 New Brunswick Ave., Rahway, N.J. •

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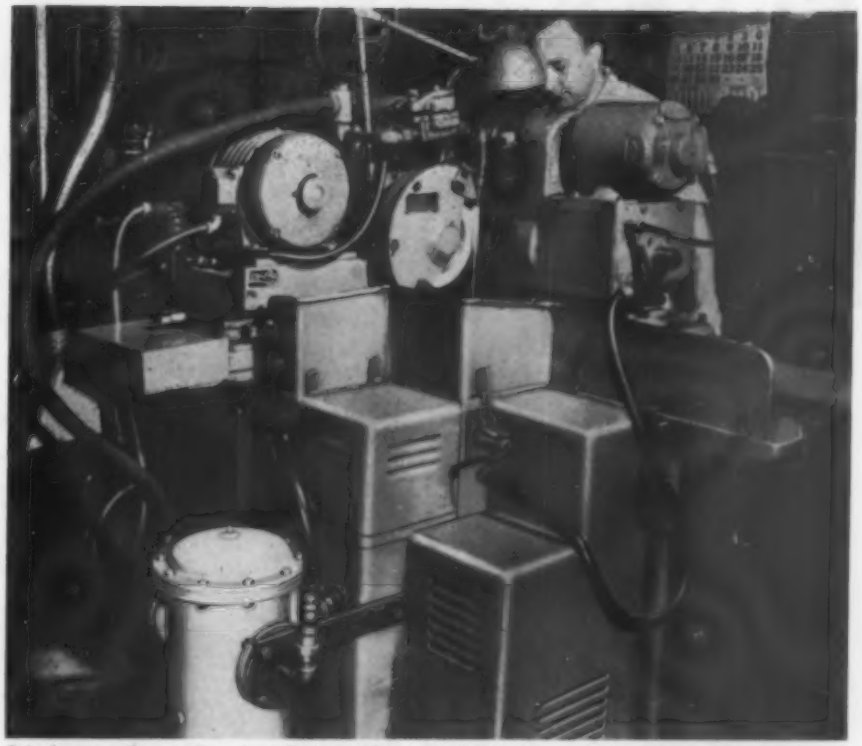

Grinding coolant filter installed on Cincinnati Filmatic grinder keeps abrasives and metal particles out of coolant resulting in scratch-free precision parts and longer pump life. Filter shown in foreground is Purolator PAG-50. Plastic impregnated cellulose filter element is accordion pleated to give greater filtering area and is capable of removing particles down to 10 microns in size from coolants.

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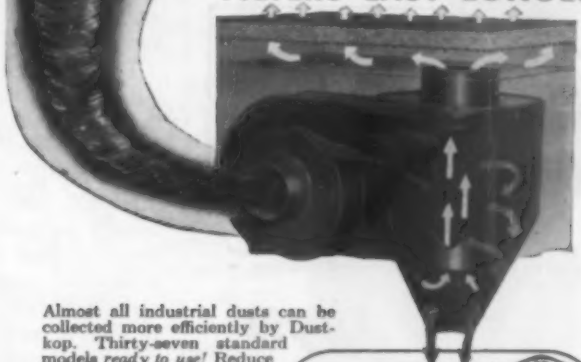

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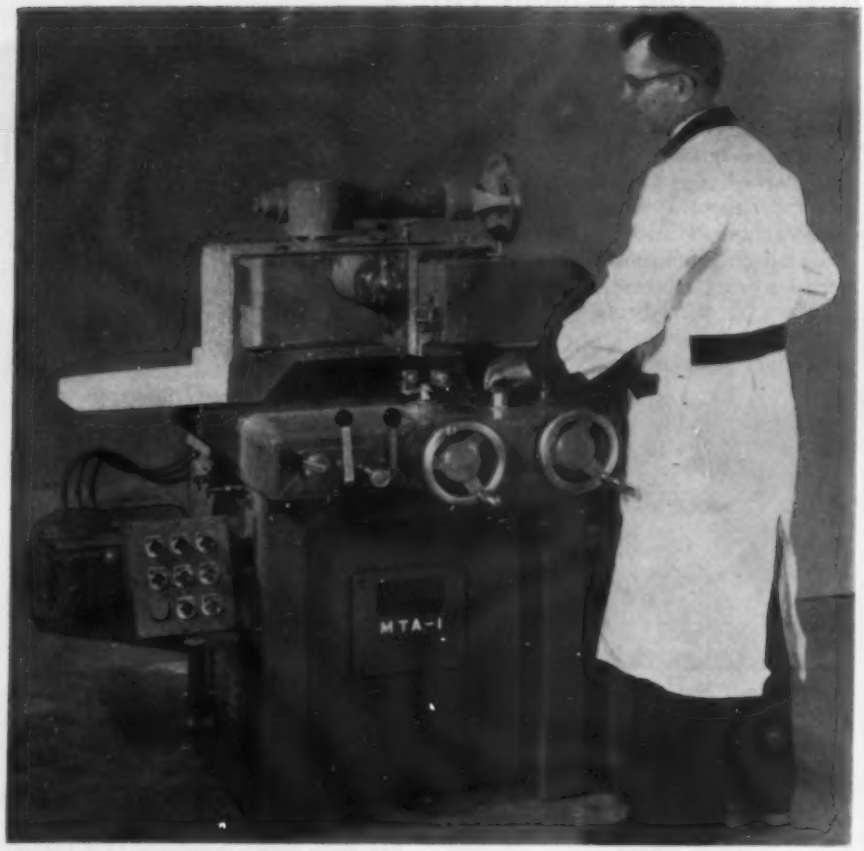


Microtomatic precision slicing machine, equipped with motorized slicing fixture. Operator is adjusting table feed which affords cutting stroke down to less than one inch per minute with quick return. Cross index adjustable from zero to .250" occurs at the return stroke.

Slicing Machine For Germanium Reduces Waste — Boosts Transistor Production

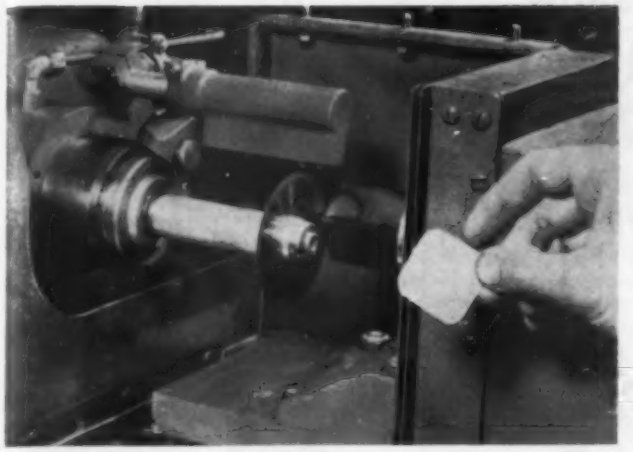
New Method Applicable to Precision Slicing of Other Materials

● The Microtomatic precision slicing machine is The DoAll Company's answer to the problems confronting manufacturers of transistors and other devices employing brittle, crystalline semi-conductors such as germanium and silicon.

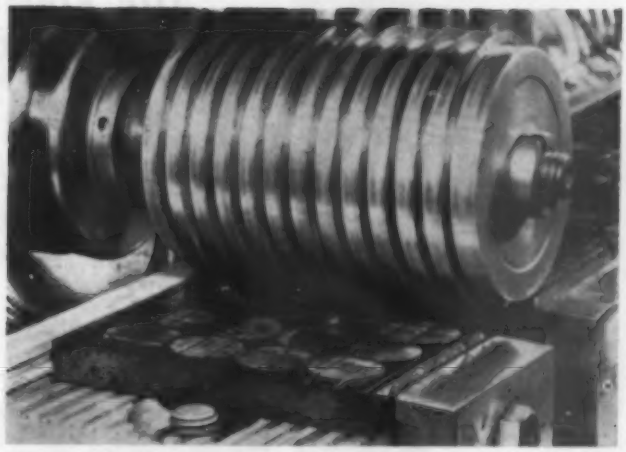
The transfer of transistors, those minute substitutes for vacuum tubes, from the laboratory to the production line, has posed some important problems. One is how to cut these critical materials into the tiny but dimensionally accurate pieces that form the working part of a transistor at the production rate required to meet a rocketing demand. Another problem is that of reducing waste in cutting these extremely expensive materials; germanium, for example, sells at about $400.00 per pound.

Raw germanium prior to cutting, is a crystal, generally in the form of an ingot 4 to 5 inches long and up to 1½ inches in diameter, though its shape is often more triangular or rectangular than cylindrical. For most transistors it must be first sliced into thin wafers .010 to .015 inches thick. Where power transistors are the end product, the entire wafer may be used but more often it is cut or "diced" into squares as small as .050 inches on a side, after which it is lapped and etched to its final thickness.

To achieve the desired electrical characteristics in the finished transistor, the crystal must be sliced relative to its crystallographic planes which are determined by X-ray examination. Because of this requirement slicing is not always done at exact right angles to the longitudinal axis of the crystal bar. As most commonly done up to now, the crystal is cemented to a work holding plate and set up on a work table in proper relation to the cutting plane of a circular diamond saw blade large enough in diameter to cut through the entire cross section of the crystal. For a 1½ inch diameter crystal bar, the thinnest practical circular diamond



Close-up of Microtomatic work table with guards removed for visibility and slicing fixture in place.



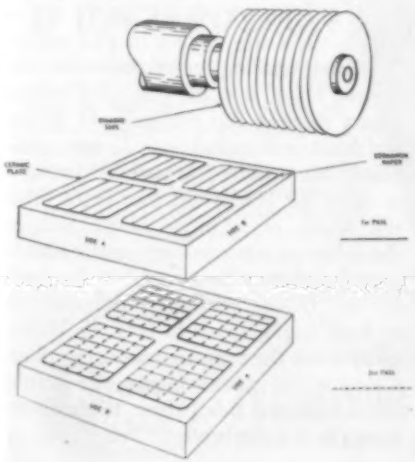
Close-up of dicing operation.

saw for this method, cuts a kerf (slot) .030 inches wide. Obviously, in producing .015 inch or .020 inch thick wafers, more of this expensive material is reduced to dust than to usable wafers.

Slicing with the Microtomatic

The machine is an automatic, hydraulically actuated, circular sawing machine employing a thin circular diamond saw blade for slicing ingots. A 6 inch by 18 inch work table provides ample room for work holding fixtures. The table moves on hand-scraped ways feeding the germanium or silicon ingots into the cutting wheel at rates as low as one sixteenth inch per minute. Easily adjusted trip dogs control the length of cutting stroke and provide automatic quick return at speeds up to 50 fpm. When slicing, automatic cross indexing takes place on the return stroke. Cross indexing can be set at the hydraulic control panel to produce slices of any desired thickness accurate to plus or minus .0005 inches. Stops are provided so that cross indexing can be adjusted to the length of the ingot or ingots being sliced. Whether one or more ingots are held in fixtures on the table or whether the DoAll slicing fixture is used, the slicing operation is automatic requiring no attention by the operator until the entire work-load is reduced to wafers.

The slicing fixture for use on the Microtomatic makes it possible to use smaller, thinner wheels, thereby reducing waste and increasing the num-



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ber of usable transistor blanks obtained from each crystal ingot. Setting up for precise automatic slicing is not difficult. Essentially, the fixture is a motorized precision headstock that can be mounted on the work table and accurately aligned parallel to the cutting spindle. Adjustable keys on the fixture base permit quick, accurate alignment of fixture to spindle. The face plate to which the end of a germanium crystal can be cemented, is a compound assembly which can be adjusted to bring the crystallographic plane into coincidence with the plane of rotation. The crystal can then be rotated at an appropriate speed during the cutting stroke. Consequently, a saw only large enough to cut to the center of the work piece will suffice. For crystals under 1½ inches in diameter, a 3-inch saw may be satisfactory. Such a circular blade reduces only .015 inches of material to dust.

Dicing

Some large power transistors make use of a complete wafer as produced by the slicing operation but most transistor blanks are made by cutting the thin wafers into tiny squares. The wafers are held for dicing by cementing them to ceramic plates which are, in turn, held by a fixture on the work table of the Microtomatic. The fixture is a serrated chuck with back stop and clamps to hold up to five 4½ inch square plates. Each plate can be covered with germanium or silicon wafers so that a full work-load might be twenty or more wafers.

The Microtomatic spindle for dicing is a special high-speed unit with a 3½ inch extension to permit mounting and spacing of a number of 3-inch diameter circular diamond saw blades. A typical setup might be twelve blades spaced .250 inches apart so that the entire width of the fixture is covered at a single pass. Slow table feed is used and the depth of cut is set to cut through the wafers in one stroke. If wheel spacing corresponds to the desired blank size, the plates are turned ninety degrees and the strips of wafers are diced in a second pass. If very small blanks are required, it may be desirable to space the blades twice or three times the width of a single blank because the adhesive area on very small blanks is reduced to a point where the force of the blades cutting simultaneously at both edges, tends to tear the blanks away from the ceramic mounting plate. Using wider spaced blades, the blanks are cut on one side. Then, the accurate cross index is brought into play to

position the work for a second cut along the other side.

Other Uses

The extremely slow and smooth feeding table, coupled with the vibrationless spindle, makes the Microtomatic capable of slicing a wide range of hard-to-machine materials. It can be used effectively on piezoelectric crystals and for slicing test blanks from small, hardened steel or tungsten carbide tools.

Large machines with bigger drive motors are available for precision parting of materials of larger cross section and greater resistance.

Design Features

The high-speed, anti-friction bearing spindle is belt driven by a one and one-half horsepower motor. Table and cross index ways are automatically lubricated through a metering pump from a reservoir of special high surface tension lubricant. Table travel and cross index movement are accomplished hydraulically. Bleeder valves on both cylinders make it possible to exhaust any traces of trapped air after a setup, change or an idle period, thus insuring positive table travel and accurate indexing from the very first cut. Table and saddle are provided with generous coolant troughs to carry coolant and grinding dust back to the reservoir which is equipped with an ultra-fine paper filter to purify the coolant and salvage valuable metallic dust. • •

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Right: When rotated at 800 RPM, Sand-O-Flex removes excess metal without disturbing close tolerances

As the sander spins, flexible brushes gently mold the abrasive cloth over irregular surfaces, "wiping off" excess metal. The abrasive unwinds from a cartridge inside the metal case and is fed out as needed. Abrasives are furnished in many grits for a wide variety of applications. Sand-O-Flex is an attachment—it fastens to any rotating spindle (motor, lathe, drill press, electric hand drill, etc.) —no special equipment necessary. Four models, from portable to heavy duty production line uses.

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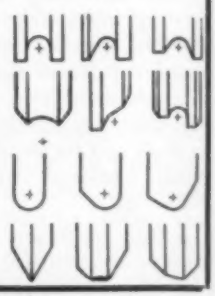

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No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B &S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY
ABERDEEN, SOUTH DAKOTA

Circle No. 263 on postpaid card

News of the Industry

Sheffield Demonstrates New Grinder To Defense Production Engineers

Reciprocating precision gear grinder to fulfill volume production needs for accurate gears shown in Dayton. Grinder designed to eliminate costly pre-forming operations; employs crush dressing of wheel form.

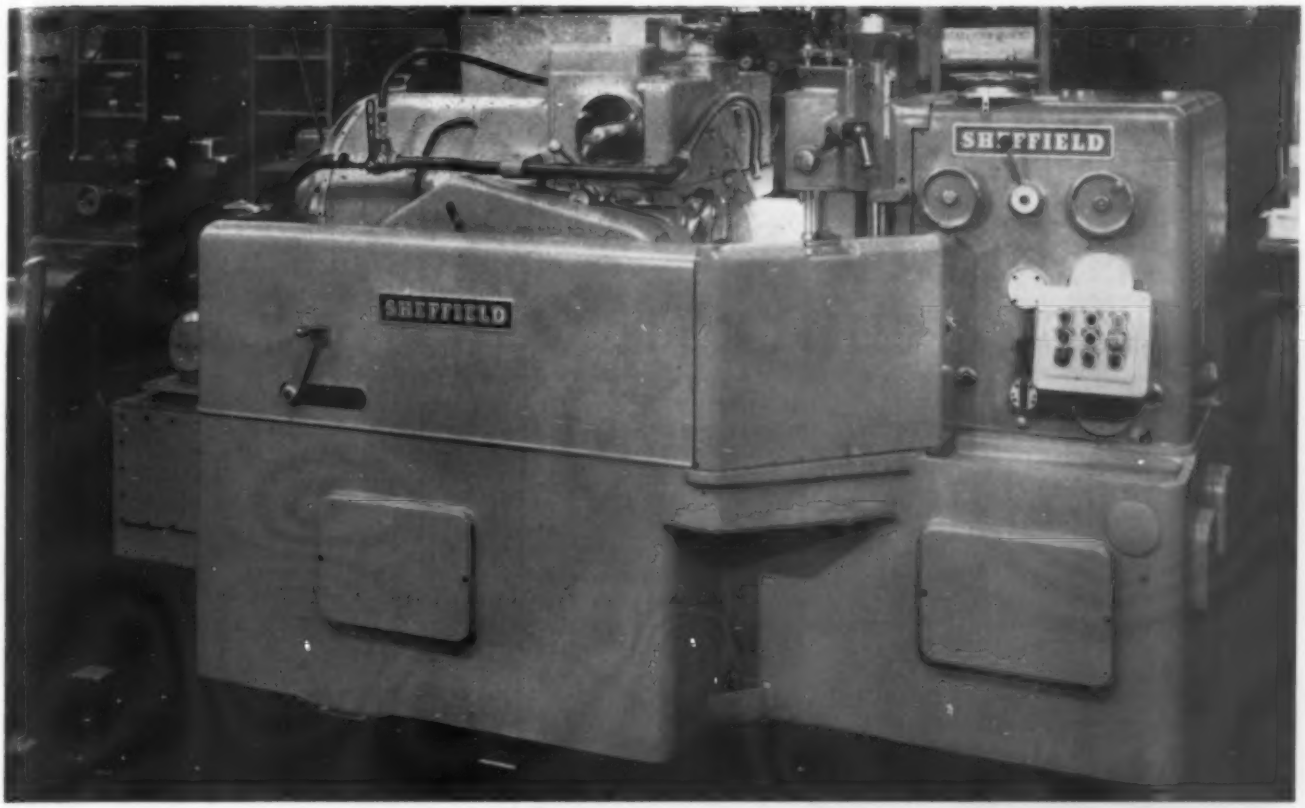
DAYTON, AUG. 16—Precision performance of a new gear grinder developed by The Sheffield Corporation to help achieve higher volume output of extremely accurate gears powering modern weapons and aircraft and ordnance controls was demonstrated in a two-day series of evaluation tests conducted here August 15 and 16 for nearly 100 officials of some of the nation's leading producers of equipment for the armed forces, and military and government engineering and production specialists.

The demonstration, held by Sheffield engineers in cooperation with the Defense Department, put the company's new Model 140 Reciprocating Gear Grinder through an exhaustive series of tests. The showing illustrated applications in production of automatic control mechanisms of fire control units, automotive transmissions, machine tool drives, aircraft missile and rocket accessory power units and timing and other devices.

The new grinder was shown to reduce many costly and slower pre-forming and finishing operations formerly necessary in producing precision gears.

The new grinder, developed after nearly seven years of research, is being employed in the production of such precision gears as those used in airborne radar controls, which must be turned out in volume to accepted tolerances.

Guests at the Sheffield Demonstrations included: John H. Williams, Department of Defense, Washington, D. C.; Col. W. R. Carter, U.S. Air Force, Washington, D.C.; R. W. Righter, U.S. Navy, Washington, D.C.; H. E. Hawkins, Department of Commerce, Washington, D.C.; D. H. Seymour, Bureau of Ships, Washington, D.C.; A. J. Stuckley, Bureau of Air, Navy, Washington, D.C.; L. E. Walker, U.S. Air Force, Washington, D.C.; Lt. Col. A. H. Alcott, Air Material Command; Clarence O. Thomas, Jr., Industrial Specialist; Fred M. Opitz, Technical Consultant at Air Material Command; Lt. Col. H. J. Ritter, Air Material Command; George L. Lang, Methods Department—Wright Patterson Air Force Base; Donald Cheeseman, Fred A. Cramer—Allis Chalmers Manufacturing Corporation, Wisconsin; Capt. Charles E. Conner, Production Chief, Aloysius R. Mokos, Engineer, Anthony Rizzuto, Engineer—A. E. Division of Ford Motor Company, Chicago, Illinois; James Bolling, Engineer, Ford Motor



The Sheffield Model 140 reciprocating precision gear grinding machine designed for grinding external precision spur and both right and left hand helical gears from 8 to 100 pitch.

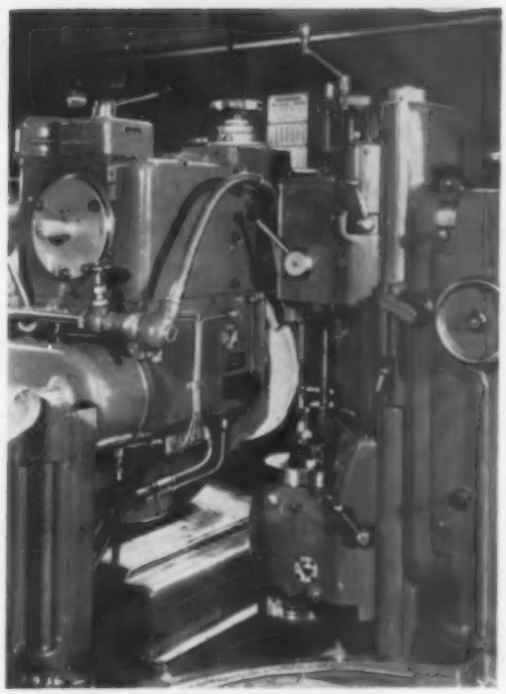
A number of gears of the same type can be ground simultaneously from hardened steel in preformed or solid blanks or, gears can be ground individually.

The grinding wheel (12"x5"x½" to 2") is formed to the basic rack form by Automatic Crushtrue dressing. The gear blank or blanks are mounted in grinding position between head and tailstock centers.

The grinding operation is similar to hobbing in that the work rotates continuously at a rate of speed synchronized with that of the grinding wheel. Simultaneously the work moves upward past the horizontal center of the wheel until the tooth form is imparted to the full face of the gear blank. In addition to this basic hobbing motion the work rolls across the full face of the helical rack form of the grinding wheel.

The standard model 140 gear grinder will accommodate a maximum work diameter of 8" O.D. x 5" face width. Maximum length between centers is 15". Change gears permit the number of teeth that can be ground to range from 4 to 192. Other capacities can be made available.

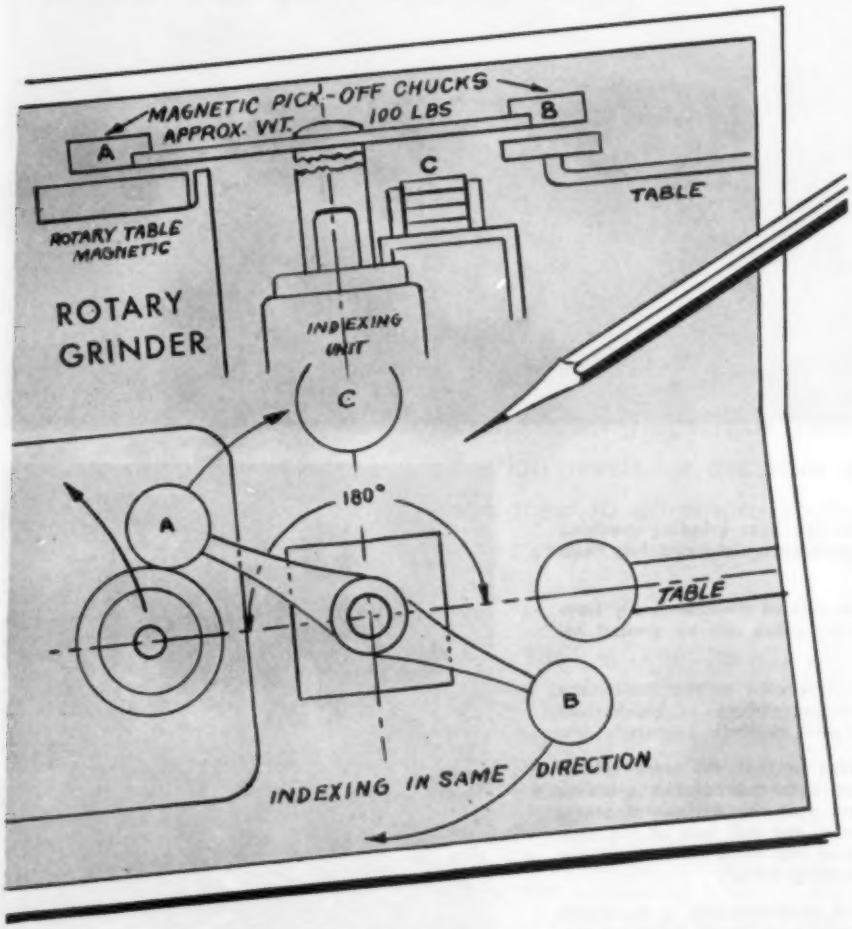
Maximum helix angle adjustment of wheelhead is 45° right and left hand. The grinding wheel is mounted on a precision pre-loaded ball bearing spindle. Grinding wheel spindle speed is 2100 r.p.m.; crushing speed, 116 r.p.m.



Company, Dearborn, Mich.; Stanley Chudy, Engineer, Ford Motor Company, Cincinnati, O.; John Allwood, Jr., Gear Specialties, Inc., Chicago, Illinois; Robert T. Jameson, Wright Patterson Air Force Base, Dayton, O., James Felts, Engineer, Chrysler Corporation, Detroit, Michigan; Clyde S. Howard, Frank Hauff, Carl V. Ruehrwein, General Electric, Evendale, O.; Sherman Peters, Dana Corporation, Toledo, O.; Walter C. Folger, Engineer, Allison Div. of General Motors Corporation; G. Young, Master Mechanic, Westinghouse Electric Corporation; William E. Clifford, Naval Air Material Center, Philadelphia, Pa.; C. E. Miller and Carl W. Hoglund, E. W. Bliss Company, Toledo, O.; Joseph W. Burns, Erie Ordnance Depot, Port Clinton, O.; Mario S. Bruno and Charles R. Bailey, Wright Aero Division of Curtiss-Wright Corporation, Woodridge, N.J.; George Richroath, Sperry Gyroscope Company, Great Neck, L. I.; C. D. Eagle, Paul C. Jordan and Albert Kornmann, Indiana Gear Works, Indianapolis, Ind.; Edward J. Bertrand, Thomas J. Lawler and Stanley Humphries, Lycoming Division of Avco Manufacturing Corporation, Stratford, Conn.; Paul Meline, Managing Editor, Hitchcock Publishing Company, Wheaton, Illinois; Ted Black, Assistant Editor of Tool Engineer Magazine, Detroit, Mich.

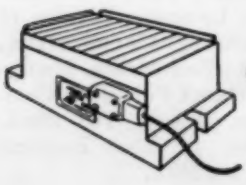
There may be a clue for you in this unusual application idea for

MAGNA-LOCK MAGNETIC CHUCKS...



Drawing shows Magna-Lock magnetic chucks incorporated in indexing mechanism designed to automatically load and unload parts from rotary surface grinder. The Magna-Lock chucks hold the work pieces during the indexing cycle. The extra holding power of Magna-Lock electro-magnetic chucks has solved many difficult problems of feeding and transferring parts as well as holding work for grinding, milling, turning.

If you have a problem, Magna-Lock has the engineering skill and experience to help you solve it. Write today, Dept. GF-96



Hanchett MAGNA-LOCK CORPORATION

BIG RAPIDS, MICHIGAN, U.S.A.

designers and makers of a complete line of magnetic chucks and devices.

Circle No. 264 on postpaid card

Metal Finishing Show Planned for Cleveland

More than 35 manufacturers of machine tools which grind and polish with coated abrasives will exhibit their newest developments to the metalworking industry in a Metal Finishing Show to be held Oct. 30 through Nov. 2 in Cleveland. The working exhibit will be sponsored by Behr-Manning Co. of Troy, N.Y., a division of Norton Company, and will take place at 4101 West 150th street, the abrasives manufacturer's Cleveland branch.

This event will afford designers, production men, quality control men and machine operators an unparalleled opportunity to submit their "problem children" components and products to actual grinding and polishing tests on virtually every coated abrasive machine tool developed in this country since the Fall of 1954, when the first of these shows took place in Chicago. For this specific purpose, exhibits will be staffed by technical representatives of the machine manufacturers, as well as by abrasives specialists of Behr-Manning Co.

Machines to be demonstrated, many for the first time, will range from heavy automatic and semi-automatic grinders used in automobile and appliance production lines to highly specialized belt machines which reach into small-radius contours. In capacity, they will cover the whole field of metalworking, from brute-force grinders capable of removing 0.100 in. per pass down to portable sanders and the miniature belt machines which polish the smallest jet-engine blades with extreme precision.

Several times daily, Behr-Manning Co. product engineers will conduct 30-minute classes, showing industrial users when to specify aluminum oxide or silicon carbide abrasives, for example, for fast cutting and cool operation; comparing the performance of cloth and paper belts; discussing recommended belt speeds, grit sizes, coolants and lubricants; and demonstrating on steels, non-ferrous metals and alloys.

A new color motion picture on metalworking will have its first showing at the Cleveland exhibit.

"Abrasive Keynotes"

Information on grinding practice written by members of the Keystone Abrasive staff or by outside authorities, is contained in "Abrasive Keynotes", free publication of Keystone Abrasive Wheel Company, of Carnegie, Penna. To receive your free copy regularly, simply write the company at the address given.

Ex-Cell-O Wins Treasury Award

In recognition of his leadership of the United States Savings Bonds Program at Ex-Cell-O Corp., H. G. Bixby, President was presented with the Achievement Award of the Treasury Department July 26. The Award was made at Ex-Cell-O headquarters in Detroit, by Noble D. Travis, Michigan Chairman of the Treasury's Savings Bonds Division.

H. G. Bixby, Ex-Cell-O President, (left) accepts U.S. Treasury Savings Bonds Program Award from Noble D. Travis, Michigan Chairman, Treasury's Savings Bonds Division.

The Award was symbolized by a copy of the first "little prayer of my own", composed and offered by Dwight D. Eisenhower immediately after he had taken the oath of office as President of the United States, on the twentieth day of January, 1953. Beautifully reproduced in colors in medieval monastic style, the prayer reproduction was made even more unique by its enclosure in a frame constructed of wood used in the inaugural platform.

Mr. Travis revealed that only twelve such copies have been presented to Michigan business executives. He also said that during the fifteen-year history of the Savings Bonds Program, Michigan has always achieved its quota, a record shared by only two other states in the Union.

Voicing his acceptance, Mr. Bixby said, "I am grateful that our organization has been honored with this award. Yet I feel personally humble when I reflect upon the patriotic shift—even to the point of sacrifices—that our people have displayed to make Ex-Cell-O worthy of this presentation. May the Savings Bonds Program enjoy success for many years to come."

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Please Mention
GRINDING & FINISHING

Only Cutter Grinder in the WORLD with all these features

END MILL CENTRA-POINT GRINDER ®

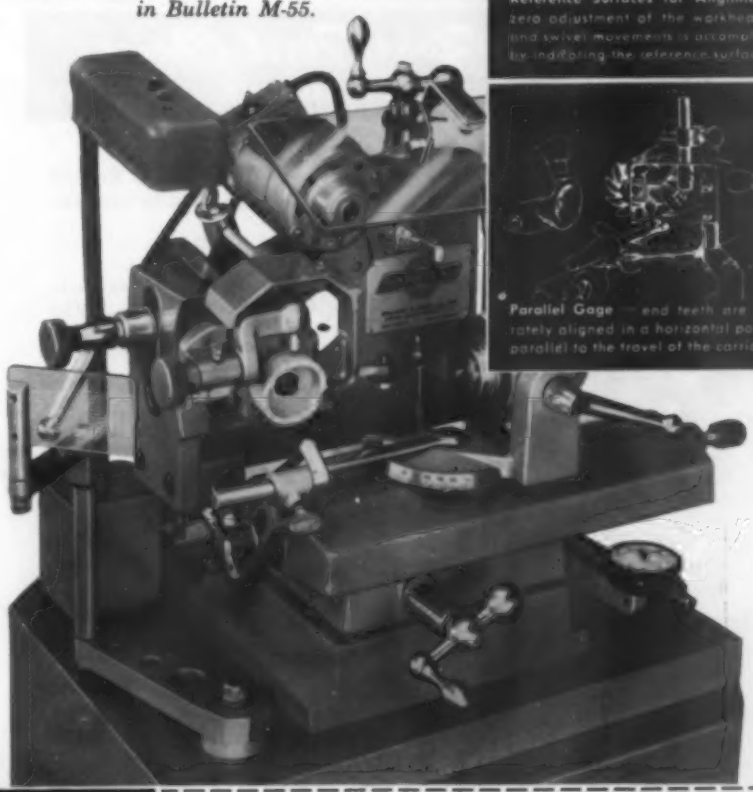
Specifically designed for sharpening the small cutters that are so difficult to grind on large machines, CENTRA-POINT is fully described in Bulletin M-55.

Clearance Angle Scale — clearance angles are read directly from a graduated scale on wheel spindle assembly

Mechanical Wheel Dressing — an accurate radius is mechanically dressed on the grinding wheel, in correct relationship to self-registering tooth rests

Reference Surfaces for Alignment — zero adjustment of the workhead tilt and swivel movements is accomplished by indexing the reference surfaces

Parallel Gage — end teeth are accurately aligned in a horizontal position parallel to the travel of the carriage



FREE

CENTRA-POINT DIVISION
William H. Field Co., Inc., 331 Dorchester Ave., Boston 27, Mass.
Please send a copy of the new CENTRA-POINT Data Sheet.

Name _____ *Title* _____
(Please Print)
Company _____
Address _____
City _____ *Zone* _____ *State* _____

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Rampe Expands

Rampe Manufacturing Co., of Cleveland, Ohio, manufacturers of a growing line of tumbling equipment announce a 50% increase of additional manufacturing space.

Armour Holds Training Session

Distributors recently attending an Armour and Company Coated Abrasives distributor training session included Mr. Howard McAtee, William S. Bolden Co., Charleston, W. Va.; Dick Jones, Newark Supply & Machine Co., Newark, Ohio; Bob Merrell and Jim McKinney, Merrell-McKinney Supply, Columbus, Ohio; Ham Ernst, Dick Lacksell and Mel Naber from Streubing & Buchheit Co., Buffalo; A. L. Hunsinger and Fred Moran from Amstan Supply Div., Youngstown.

Motion Picture on Cutting Fluids Offered

Cutting Fluids, a 19½-minute sound-on-film color motion picture recently released by The Texas Company, shows how cutting fluids work to cut down the harmful effects of heat and friction created during the metal-cutting process.

After a basic discussion of how a cutting tool works, the film is divided into two parts—cutting oils, and water-based emulsions (solubles).

In the first of these sections the various materials that go into a cutting oil are pointed out, and each of these components is analyzed, to see how it prevents or cures the heat problems that arise during chip formation. In particular, the role of such additives as sulfur, chlorine, and fatty oils is described. Because care must be used in certain cases to see that the additives do not create other problems, such as staining and corrosion, rules are given to help the user stay out of trouble of this kind.

In the second section on water-based cutting fluids, the film tells how a properly made and properly handled emulsion can combat the problems of heat, bacteria, rust, and extreme metal-working pressures. Rules are given for how to make up an emulsion, how to keep it clean, and how to test it to see that it is of the proper strength and composition.

The Texas Co., 135 E. 42nd St., New York 17, N.Y.

American Emery Wheel Works Appoints Director of Research

The appointment of **Adolph H. Kuechler** as Director of Research has been announced by American Emery Wheel Works, Providence, R. I., manufacturers of grinding wheels and bonded abrasive products.

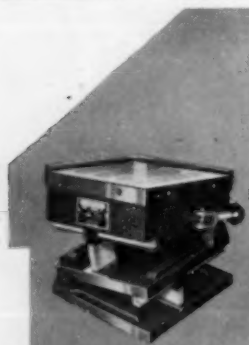
Mr. Kuechler holds degrees in Ceramic Engineering, Geological Engineering, and Metallurgy from Ohio State University and the Universities of Missouri and Montana. He is a member of the American Ceramic Society, National Institute of Ceramic Engineers, and the American Society for Metals.

He was formerly Director of Research for A. P. de Sanno & Son, Inc., and has previously served as a production executive with the Waltham and Sterling Grinding Wheel Companies.

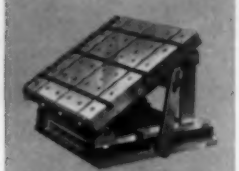
Simonds Worden White Co., Dayton, Ohio has announced the appointments of **Casey Natonski** and **Pete Bojanic** as Field Abrasive Engineers.

Natonski has been assigned to the Chicago office, covering Illinois, Wisconsin and Missouri. He was formerly associated with the Ford Motor Co., Aircraft Engine Div. as an abrasive engineer.

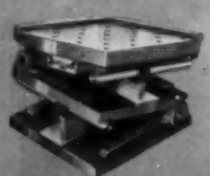
Bojanic will serve Penna., New York, New Jersey and Eastern Ohio. He was formerly a methods engineer in charge of abrasive control with Thompson Products, Inc., Harrisburg, Pa.



"Magna-Sine" Magnetic Sine Plates for precision set-ups grinding single or compound angles.



Heavy Duty Sine Plates for angular machining. Wide variety of sizes. 12" square model shown.



Inspection Sine Plates for precision inspection and light machining on single or compound angles.

1ST

Your First Choice

FOR ANGULAR TOOLING....ROBBINS!

A look at the record shows exactly why Robbins equipment for angular tooling should be your first choice! Here's the record:

1ST to originate the idea of a simple sine plate for faster angular toolroom set-ups—*1936*

1ST to build these as a standard product for general distribution—*1936*

1ST to build a non-magnetic sine plate designed specifically for precision inspection —*1946*

1ST with a permanent magnet chuck—*1948*

1ST heavy duty sine plate for angular machining—*1954*

1ST *and the only one with* the exclusive "PERMA-FLAT" SWIVEL BLOCK—*1956*

Robbins is the only sine plate manufacturer with a complete line of sine plates for every angular set-up problem in precision machining, grinding and inspection. We also offer complete engineering and manufacturing facilities for the solution of special problems, and are now building high-production automatic assembly and other special machines. Send for sine plate literature, or send us details of your requirements in special machinery.

OMER E. *Robbins* COMPANY

24800 PLYMOUTH ROAD Dept. A DETROIT 39, MICH.

Also producers of special machinery, gages and fixtures

Circle No. 266 on postpaid card

Indiana Steel Products Forms New Division

Indiana Steel Products Co., Valparaiso, Ind. has acquired the magnet and separator assets of the Stearns Magnetic Inc., Milwaukee, Wisc. Operations will continue as Stearns Magnetic Products, a Division of Indiana Steel Products Co. at 635 So. 28th Street, Milwaukee. The newly acquired products will include pulleys, lifting magnets, parts separators, drums, metal detectors and concentration and beneficiation equipment.

The brakes, clutches and clutch-brakes formerly made by Stearns Magnetic Inc. will be manufactured by the Stearns Electric Corp. at 120 N. Broadway, Milwaukee, Wisc.

Ultrasonic Grinding Service

An ultrasonic impact grinding service for close-tolerance orifices in the hardest and most brittle materials is now being offered to industry by the C-Mar Corp., Manasquan, N.J.

The service, created to expedite the flow between the design and assembly of components requiring precisioned apertures, provides new freedom for design and production engineers. The ultrasonic impact grinding service has diverse industrial applications: Ceramics, ferrite, germanium, glass, glass-bonded mica, graphite, hardened steel, quartz, rexalloy, silicon, tungsten and other materials being ideally suited.

Shipping Cartons for Grinding Wheels

Small tool room grinding wheels are now being shipped by the dozen and in egg-crate style to reduce damage in shipping and handling and to simplify inventory problems for the customer.

Electro Refractories & Abrasives Corp. of Buffalo, N.Y. devised the shipping technique, which utilizes double-faced corrugated cartons of interior airfloat construction. The cartons cut down on shipping weight and completely eliminate sawdust and shredded packing materials. Each box is marked with the company name and details the contents.

Shipments do not have to be unpacked for storaging and when they are opened there is no mess to sweep up. Meantime the inventory man counts boxes instead of individual wheels, which saves him work and his employer money. The cardboard cartons accommodate four to six inch cup wheels.

. . . and you can change your method of cylindrical grinding to obtain MICRO-FINISH with POSITIVE ROUNDNESS!

The RED-E new grinding concept is so graphically an improvement over conventional methods that even the 'die-hards' are changing over. Old-timers throughout the country have convincing proof that chatter, wheel-marks, out-of-roundness and costly secondary operations can be eliminated and controlled . . . that roundness is only as accurate as the Center hole alignment. With RED-E they now achieve super-finishes in cylindrical grinding!

Send for the new RED-E Concept Booklet! It explains how you can obtain the ultimate in grinding accuracies to within less than 50 millionths (0.000050") t.i.r.

Mail Coupon Today

READY TOOL CO.
566 Iranistan Ave., Bridgeport 5, Conn.

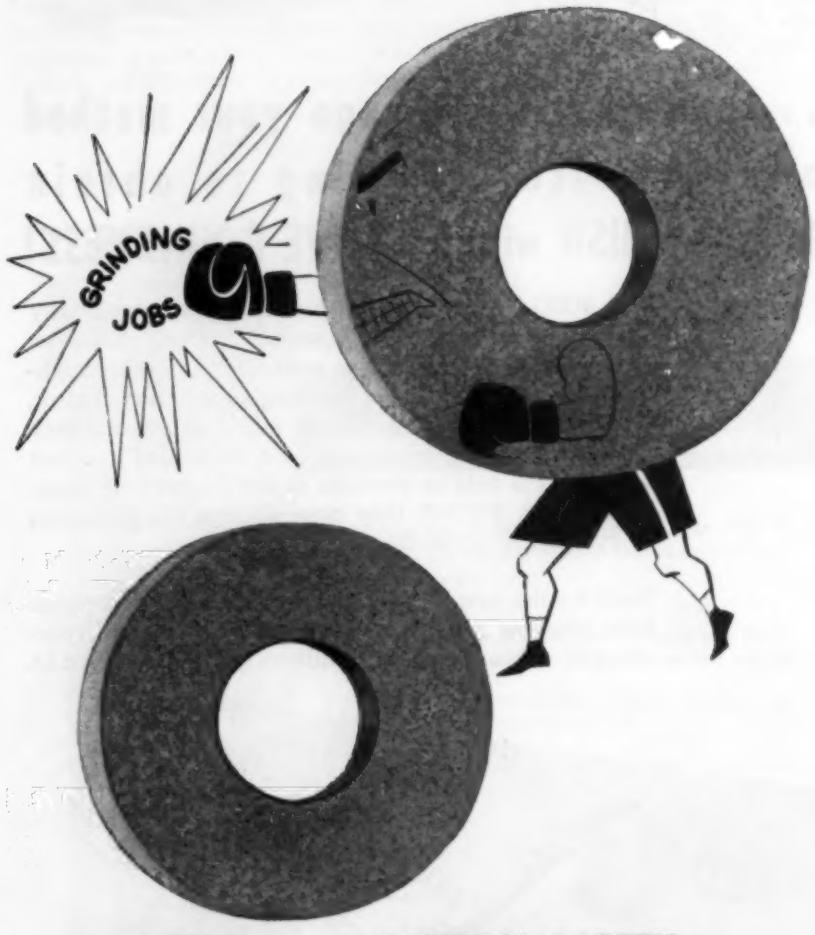
Gentlemen:
Please rush ( ) copies of your Concept Booklet.
☐ May we have your new Center Catalog, too, please?

Name .....
Address .....
Company .....
City ..... Zone ..... State .....

Circle No. 267 on postpaid card

We don't care how

TOUGH they come!



DAYTON SAFETY GRINDING WHEELS

We have been solving tough grinding jobs for industry for over 50 years!

Dayton Safety Grinding Wheels have never failed to meet any test.

What is your toughest grinding problem?

We'll bet we can solve it.

Write for catalogue or the name of your nearest distributor.

SIMONDS WORDEN WHITE COMPANY

1101 Negley Place • Dayton 7, Ohio

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Paul N. Gillon, formerly in charge of the Office of Ordnance Research at Duke University, has been appointed Manager of the Basic Research Branch of The Carborundum Company's Research Laboratory, according to an announcement by Mr. Leslie E. Simon, Director of the Division.

In his new position with Carborundum, Mr. Gillon will direct a basic research group whose purpose is to acquire new scientific knowledge, keep abreast of the sciences related to Carborundum's endeavors, and transmit new knowledge to persons in other branches of the Research & Development Division of Carborundum. Mr. Gillon has also been designated Project Coordinator, responsible to insure that Research & Development projects cover the range of the Company's product interests, prevent duplication of effort, and effect exchange of information between the Central Laboratory at Niagara Falls and product engineering branches of the Operating Divisions.

Mr. Gillon has held many important posts in Ordnance Research for the U. S. Army. Since August 1954 he has been Commanding Officer, directing the entire basic research program of the Office of Ordnance Research at Durham, North Carolina.

A West Point graduate, Mr. Gillon has attended Harvard University Graduate School of Business Administration and also had a year of postgraduate work at Harvard in Engineering Physics. He holds the degree of Master of Science from Massachusetts Institute of Technology.

For his outstanding service in providing ballistic data urgently needed by the Armed Forces, for providing extensive new computing and research facilities which greatly enhanced the value of our weapons and material improvement while a colonel in the Army, Gillon was awarded the Legion of Merit. He was also awarded the Bronze Star Medal for meritorious service in connection with military operations against the enemy.

Harold L. Gebike, of 108 Leonard Ave., Buffalo, N.Y. secretary-treasurer of Electro Refractories & Abrasives Corp., has been named chairman of the National Committee on Ethics and Eligibility Standards of the Controllers Institute of America for the 1956-57 fiscal year. Mr. Gebike served as a committee member during the past fiscal year.

Appointment of **Theodore Bolton** as Cleveland Manager of Chicago Wheel and Manufacturing Company has just been announced. In his new post Bolton will be responsible for the merchandising and distribution of the complete line of Chicago Mounted Wheels, Handee Grinders and the other items manufactured by this concern.

A native of Cleveland, Mr. Bolton was educated in local schools. Upon leaving school he served in the industrial distribution field. He has covered most phases of engineering and purchasing in the grinding and abrasive fields.

Charles B. Martin has been appointed an abrasive engineer by Norton Company. His territory will include West Virginia. Mr. Martin has been a field engineer at Norton's Pittsburgh district office since 1945. Prior to joining the company in 1945, he worked as an inspector for the Pittsburgh Rolls Division of Blaw-Knox Company for 12 years.

Charles B. Martin

John M. Mele, abrasive engineer, formerly in the Cleveland area representing the Bay State Abrasive Products Co., Westboro, Mass., has been transferred to the New York City area it was recently announced by Elden L. Auker, Vice President in Charge of Sales.

Mr. Mele joined Bay State in August 1951. Prior to his affiliation with the Westboro concern, he was employed by the Shell Oil Company for several years in the field of industrial lubricants.

He is a graduate of Cornell University and received a degree of Bachelor of Science in Mechanical Engineering.

John M. Mele

SANFORD
SURFACE GRINDER
MODEL MG

For Dry or Wet* Grinding!

PRECISION • SPEED • SENSITIVITY

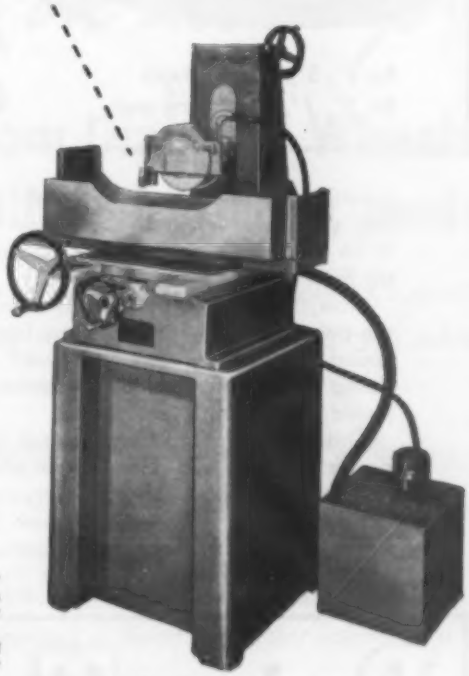
Built by manufacturers who concentrate on small grinders only, each Sanford Grinder is an individual project of time tested and proved basic design. Although modest in price, no quality undermining shortcuts are employed to reduce manufacturing costs. Constant repeat orders prove its acceptance.

This sensitive machine grinds to micro-inch accuracy with no vibration, with maximum dimensional stability. Here's why:

- **Transverse ways are double Vee (VV) Meehanite inserts instead of flat surfaces which depend upon unstable jibs for alignment and accuracy.**
- **Needle, Ball and Oilite Anti-Friction bearings are used throughout.**
- **Alignments are electronically checked for accuracy.**
- **Precision slides are ground, lapped and hand spotted.**
- **Dials are large and legible.**

SPECIFICATIONS — 8¾" transverse — 13" longitudinal — 12" vertical under 7" wheel with Adapter. Approximate weight 630 lbs. Send for illustrated bulletin.

Replacement parts, special attachments and reconditioning facilities are available. Send for price list.



*With optional equipment

SANFORD MANUFACTURING CORP.
1026G Commerce Ave., Union, N. J.

Circle No. 269 on postpaid card

If you think you've seen this ad before—you're absolutely right! Because this new Buckeye tool offers so many outstanding benefits to anyone doing production abrasive work, we're repeating this ad to make sure you'll know what this tool can do for you.

Here's a brand-new

"2-in-1"

BUCKEYE ABRASIVE TOOL!

handles like an angle...

runs like a vertical...

AND, IT'S QUIET!

for 4", 5", 6" cup wheels
for 5", 7", 9" sanding pads

Take hold of this newest Buckeye abrasive tool . . . it has the feel and balance, and the ease of handling you expect only in an angle tool. And—it has the gearless efficiency and direct air flow of a vertical tool.

Now, turn it on. That handy twin-trigger throttle gives you pin-point control of the air flow from zero right on up to top speed. Notice how quietly it runs? That's the built-in muffler doing its job. The exhaust deflector, underneath, can be adjusted to any angle you choose.

This NEW Buckeye abrasive tool is available in five speeds, comes complete with dead handle and guard. If you'd like more information, just write—now—for our Catalog A-10. If you'd like to see what this new tool can do on your work, just tell us so and we'll make the necessary arrangements—without obligating you at all.

Buckeye Tools CORPORATION
DIVISION 45 • DAYTON 1, OHIO

producers of the world's first successful rotary air tools

Circle No. 270 on postpaid card

Micrometrical Mfg. Co., Ann Arbor, Mich. announces the promotions of **Fritz A. Zander** to Executive Vice President and **Frank W. Kabat** to Director of Sales.

Fritz A. Zander

Frank W. Kabat

Russell S. Whitehead has been promoted to Southeast district sales manager and **Donald W. Withrow** and **Arthur L. Rose** have been appointed sales representatives of Electro Refractories & Abrasives Corp.

With Electro since 1942, Whitehead is now responsible for sales of grinding wheels, refractories and crucibles in the St. Louis to Birmingham area and will supervise salesmen located in each of those two cities.

Donald W. Withrow will work out of Birmingham as sales representative for all Electro products for Alabama, North Carolina, South Carolina, Tennessee, Mississippi and Georgia.

Arthur L. Rose, Jr., is now representing the company for grinding wheel sales in the Detroit area. He is the former purchasing agent for the American Spring Co., of Holly, Mich.

Cleveland Instrument Company Inc., Cleveland, announces the appointment of **Fred Witzke** as manager of sales engineering, and **Jack Kerrigan** as sales engineer. Appointments were effective June 1 and July 1, respectively.

Mr. Witzke has an extensive background in electro-mechanical instrumentation. Prior to joining Cleveland Instrument, he was associated for 4 years with Brush Electronics Company as product supervisor for gaging equipment. He is a member of the Society of Automotive Engineers and has served on the American Standards Association Committee ASA B.46 on Surface Finish.

Prior to joining Cleveland Instrument Company, Mr. Kerrigan was manager of the Cleveland territory of Acme Wire Company, with whom he was associated for 6 years. He received an electrical engineering degree from the University of Notre Dame.

Fred Witzke

Jack Kerrigan

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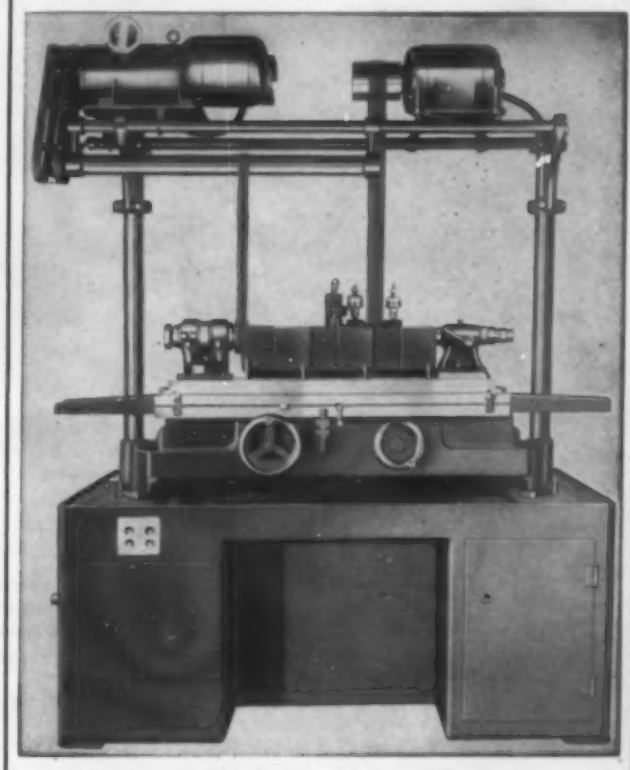
WHY WILL A 1956 CRYSTAL LAKE GRIND ROUND FROM .000005 TO .000020 BOTH LIVE AND DEAD CENTER?

Your 1956 Crystal Lake Grinder can be equipped with Rex Super Van High Speed Steel, double taper spindles. Due to their high hardness, high tungsten content, spindles will run without clearance in bearings after they have been stabilized and ground to .000005 in. roundness. Spindles are set in boxes with heavy oil drag, and, DUE TO THE NINETY DEGREE OVERHEAD DRIVE, AMPLE POWER CAN BE USED TO ROTATE SPINDLE WITHOUT HEADSTOCK AND WHEELHEAD BECOMING CUMBERSOME AND HEAVY TO MOVE FOR SHOULDER GRINDING, ALSO, BELT PRESSURE IS NINETY DEGREES FROM GRINDING PRESSURE.



A choice of General Electric Thymotrol, General Radio Variac, or Variable Speed Drive can be used without ripple or cine' wave being transmitted to work as all motors are mounted on self-contained countershaft.

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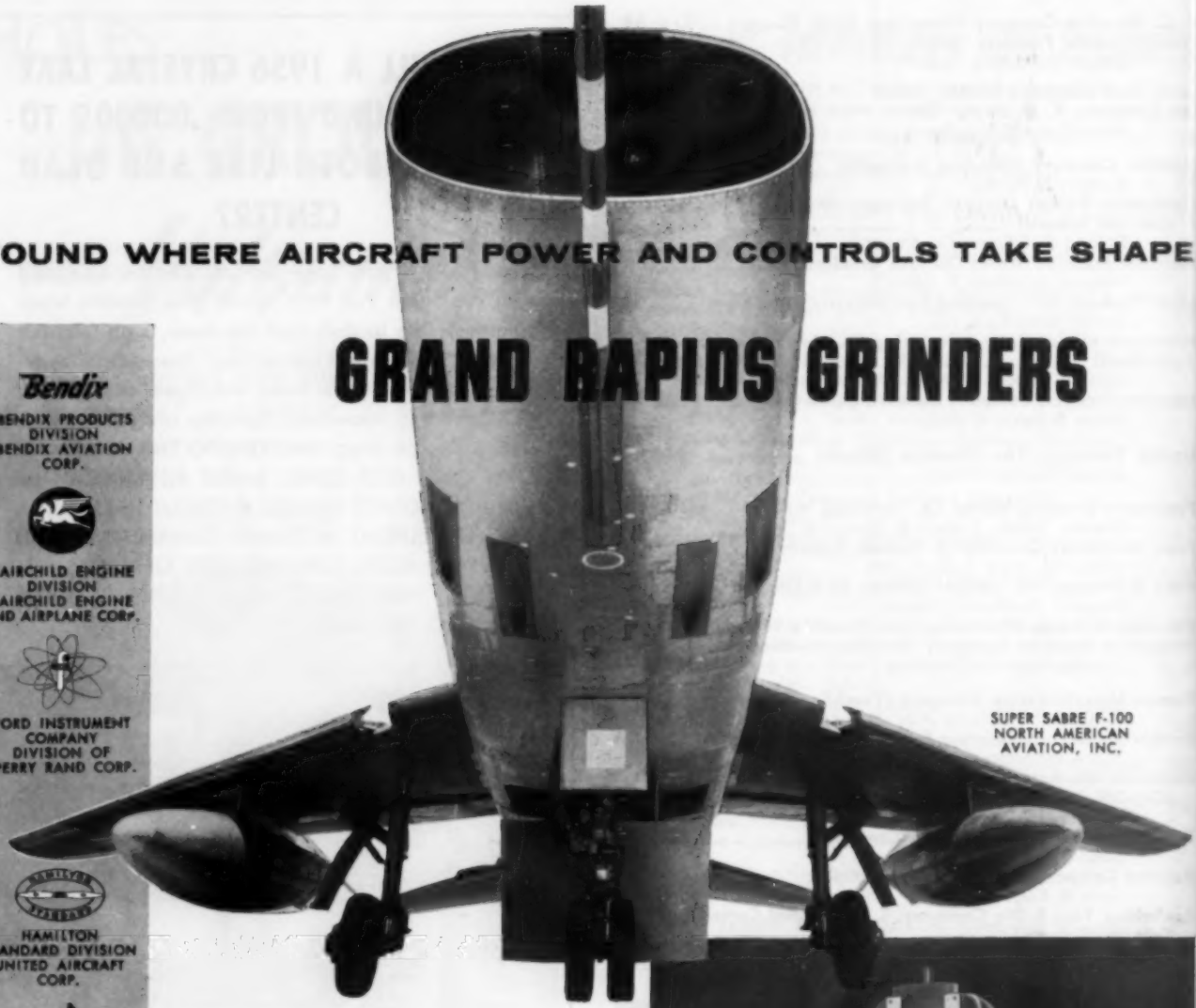

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Precision is paramount in the manufacture of components for aircraft power and control. That's why these makers of precision parts have Grand Rapids Grinders in their toolrooms — for the utmost in precision grinding.

Model No. 55, for example, features one-piece column and base for permanent vibrationless rigidity. Longitudinal travel table and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. And it's faster than any other grinder of this type and size . . . with variable table speed up to 125 fpm.

With these built-in precision features typical of all Grand Rapids Grinders, it's no wonder they're found in leading toolrooms.

GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

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416 Straight Ave., S.W., Grand Rapids, Michigan

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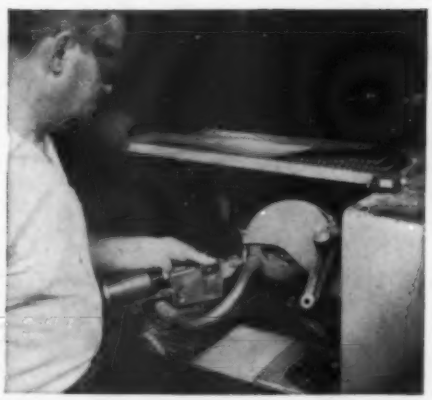


Grinding savings of both time and money often are hidden in unsuspected places. Peninsular Abrasive Engineers can quickly flush them into the open by making a comprehensive analysis of your complete operation. Their reports already have netted thousands of dollars a year for plants across the country.

For example, a semiautomatic machine stood idle for redressing after pointing only 8-10 high-speed drills. When Peninsular engineered a new wheel, production soared 400%, to 45-50 pieces between dressings, drastically cutting expensive downtime. In addition, wheel life increased 20%.

Call, write, or wire us today.

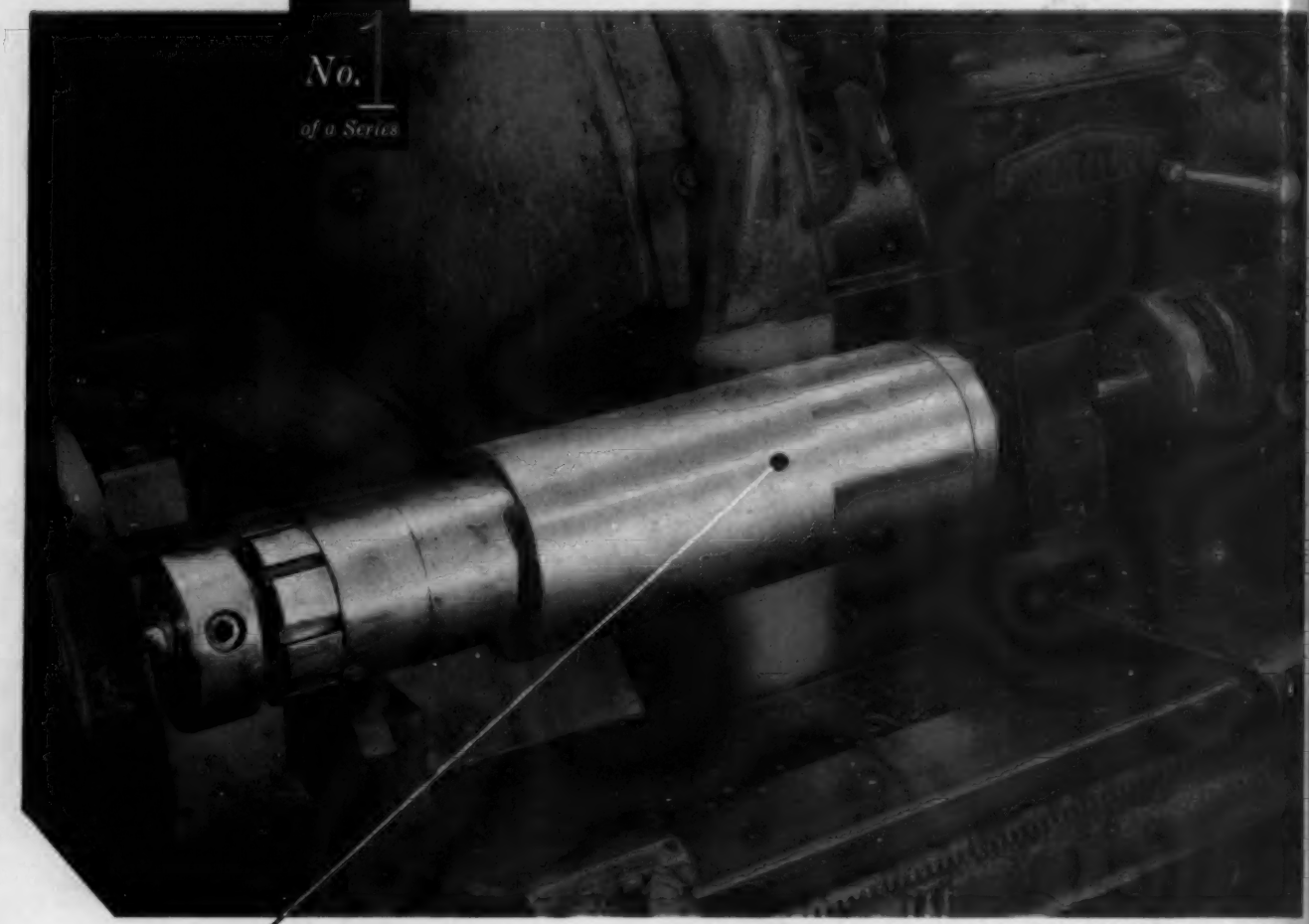
Vitrified and Resinoid Grinding Wheels

PENINSULAR

GRINDING WHEELS

PENINSULAR GRINDING WHEEL DIVISION—ABRASIVE AND METAL PRODUCTS COMPANY—DETROIT, MICHIGAN

Erickson Precision Expanding Mandrels Solve Grinding Problems



Photos Courtesy Thompson Products, Inc., Clarkwood Rd. Plant, Cleveland, Ohio

e.g. engine cylinder liners

Thompson Products, Inc., leading automotive and aircraft parts producer, originally bought Erickson precision expanding mandrels to secure better concentricity and wall thickness of a cylinder liner . . . they had formerly used single taper type expanding sleeves.

Erickson mandrels grip over the entire I.D. surface of the liner . . . thus insuring a uniform wall thickness. So Thompson switched to Erickson precision expanding mandrels for rough machining and grinding, as well as checking.

AA-2233

Collet Chucks
Floating Holders
Tap Chucks

ERICKSON TOOL COMPANY

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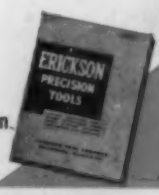
Tap Holders
Air-Operated Chucks
Expanding Mandrels
Special Holding Fixtures



Instantaneous self-release speeds loading and unloading. Application (above) uses multiple-sleeve construction to hold work part along its entire length for utmost precision.

Bothered by a tough internal holding problem? Then let us show you how Erickson mandrels speed production, lower grinding costs. Call us or write for Catalog K.

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